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DRINKING WATER SURVEILLANCE PROGRAM

HAMILTON WATER SUPPLY SYSTEM

ANNUAL REPORT 1990

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HAMILTON
WATER SUPPLY SYSTEM

DRINKING WATER SURVEILLANCE PROGRAM

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EXECUTIVE SUMMARY

DRINKING WATER SURVEILLANCE PROGRAM

HAMILTON WATER SUPPLY SYSTEM
1990 ANNUAL REPORT

The Drinking Water Surveillance Program (DWSP) for Ontario is a monitoring program providing immediate, reliable, current information on drinking water quality. The DWSP officially began in April 1986 and is designed to eventually include all municipal supplies in Ontario. In 1990, 76 systems were being monitored.

The Hamilton water supply system is a conventional treatment plant which treats water from Lake Ontario. The process consists of coagulation, flocculation, sedimentation, filtration, fluoridation and disinfection. This plant has a designed capacity of 909.0 x 1000 m^3/day. The Hamilton water supply system serves a population of approximately 412,000.

Water at the plant and at three locations in the distribution system was sampled for the presence of approximately 180 parameters. Parameters were divided into the following groups: bacteriological, inorganic and physical (laboratory chemistry, field chemistry and metals), and organic (chloroaromatics, chlorophenols, pesticides and PCB, phenolics, polyaromatic hydrocarbons, specific pesticides and volatiles). Samples were analyzed for specific pesticides and chlorophenols twice a year in the spring and fall.

Table A is a summary of all results by group.

One organic parameter, hexachlorobenzene, was reported above the World Health Organization guideline value in one sample. Since all other results (23 samples in the raw, treated and distributed water) were below the detection level, this one positive value is considered anomalous.

The Hamilton water treatment plant, for the sample year 1990, produced good quality water and this was maintained in the distribution system.

TABLE A
DRINKING WATER SURVEILLANCE PROGRAM HAMILTON WSS

SUMMARY TABLE BY SCAN

A POSITIVE VALUE DENOTES THAT THE RESULT IS GREATER THAN THE STATISTICAL LIMIT OF DETECTION AND IS QUANTIFIABLE
A '.' INDICATES THAT NO SAMPLE WAS TAKEN

	SCAN	SITE TESTS	RAW POSITIVE	RAW %POSITIVE	TREATED TESTS	TREATED POSITIVE	TREATED %POSITIVE	SITE 1 TESTS	SITE 1 POSITIVE	SITE 1 %POSITIVE	SITE 2 TESTS	SITE 2 POSITIVE	SITE 2 %POSITIVE	SITE 3 TESTS	SITE 3 POSITIVE	SITE 3 %POSITIVE
	BACTERIOLOGICAL	18	16	88	6	0	0	6	0	0	2	0	0	3	0	0
	CHEMISTRY (FLD)	13	13	100	25	24	96	57	45	78	12	12	100	28	28	100
	CHEMISTRY (LAB)	132	110	83	132	106	80	228	208	91	76	70	92	152	141	92
	METALS	144	53	36	144	41	28	276	117	42	92	40	43	184	86	46
	CHLOROAROMATICS	84	0	0	84	0	0	84	1	1	28	0	0	56	0	0
	CHLOROPHENOLS	12	0	0	12	0	0	.	.	.	.	.	.	.	.	.
	PAH	102	0	0	102	0	0	17	0	0	.	.	.	17	0	0
	PESTICIDES & PCB	204	0	0	192	0	0	127	0	0	42	0	0	85	0	0
	PHENOLICS	6	0	0	6	1	16	.	.	.	.	.	.	.	.	.
	SPECIFIC PESTICIDES	58	0	0	58	0	0	6	0	0	2	0	0	4	0	0
	VOLATILES	174	0	0	174	24	13	145	20	13	29	4	13	116	16	13
TOTAL		947	192		935	196		946	391		283	126		645	271	

DRINKING WATER SURVEILLANCE PROGRAM

HAMILTON WATER SUPPLY SYSTEM
1990 ANNUAL REPORT

INTRODUCTION

The Drinking Water Surveillance Program (DWSP) for Ontario is a monitoring program providing immediate, reliable, current information on drinking water quality. The DWSP officially began in April 1986 and is designed to eventually include all municipal supplies in Ontario. In 1990, 76 systems were being monitored.

Appendix A has a full description of the DWSP.

The DWSP was initiated for the Hamilton water treatment plant in the summer of 1986. Previous annual reports have been published for 1986, 1987, 1988 and 1989.

PLANT DESCRIPTION

The Hamilton water supply system is a conventional treatment plant which treats water from Lake Ontario. The process consists of coagulation, flocculation, sedimentation, filtration, fluoridation and disinfection. This plant has a designed capacity of 909.0 x 1000 m^3/day. The Hamilton water supply system serves a population of approximately 412,000.

The sample day flows ranged from 130.9 x 1000 m^3/day to 434.1 x 1000 m^3/day.

General plant information is presented in Table 1 and a schematic of plant processes, chemical addition points and sampling locations in Figure 1.

SAMPLING AND ANALYSES

Sample lines in the plant were flushed prior to sampling to ensure that the water obtained was indicative of its origin and not residual water standing in the sample line.

At all distribution system locations two types of samples were obtained, a standing and a free flow. The standing sample consisted of water that had been in the household plumbing and service connection for a minimum of six hours. These samples were used to make an assessment of the change in the levels of inorganic compounds and metals, due to leaching from, or deposition on, the plumbing system. The only analyses carried out on the standing

samples therefore, were General Chemistry and Metals. The free flow sample represented fresh water from the distribution main, since the sample tap was flushed for five minutes prior to sampling.

Attempts were made to capture the same block of water at each sampling point by taking the retention time into consideration. Retention time was calculated by dividing the volume of water between two sampling points by sample day flow. For example, if it was determined that retention time within the plant was five hours, then there would be a five hour interval between the raw and treated sampling. Similarly, if it was estimated that it took approximately one day for the water to travel from the plant to the distribution system site, this site would be sampled one day after the treated water from the plant.

Stringent DWSP sampling protocols were followed to ensure that all samples were taken in a uniform manner (see Appendix B).

Plant operating personnel routinely analyze parameters for process control (Table 2).

Water at the plant and at one location in the distribution system was sampled for the presence of approximately 180 parameters. Parameters were divided into the following groups: bacteriological, inorganic and physical (laboratory chemistry, field chemistry and metals), and organic (chloroaromatics, chlorophenols, pesticides and PCB, phenolics, polyaromatic hydrocarbons, specific pesticides and volatiles). Samples were analyzed for specific pesticides and chlorophenols twice a year in the spring and fall. Laboratory analyses were conducted at the Ministry of the Environment facilities in Rexdale, Ontario.

RESULTS

Field measurements were recorded on the day of sampling and were entered onto the DWSP database as submitted by plant personnel.

Table 3 contains information on delay time between raw and treated water sampling, flow rate, and treatment chemical dosages.

Table 4 is a summary break-down of the number of water samples analyzed by parameter and by water type. The number of times that a positive or trace result was detected is also reported.

Positive denotes that the result is greater than the statistical limit of detection established by the Ministry of the Environment laboratory staff and is quantifiable. Trace (<T) denotes that the level measured is greater than the lowest value detectable by the method but lies so close to the detection limit that it cannot be confidently quantified.

Table 5 presents the results for parameters detected on at least one occasion.

Table 6 lists all parameters analyzed in the DWSP.

Associated guidelines and detection limits are also supplied on Tables 5 and 6. Parameters are listed alphabetically within each scan.

DISCUSSION

GENERAL

Water quality was judged by comparison with the Ontario Drinking Water Objectives publication (ODWOs). When an Ontario Drinking Water Objective (ODWO) was not available, guidelines/limits from other agencies were used. These guidelines were obtained from the Parameter Listing System database.

IN THIS REPORT, DISCUSSION IS LIMITED TO:

- **THE TREATED AND DISTRIBUTED WATER;**
- **ONLY THOSE PARAMETERS WITH CONCENTRATIONS ABOVE GUIDELINE VALUES; AND**
- **POSITIVE ORGANIC PARAMETERS DETECTED.**

BACTERIOLOGICAL

Guidelines for bacteriological sampling and testing of a supply are developed to maintain a proper supervision of its bacteriological quality. Routine monitoring programs usually require that multiple samples be collected in a given system. Full interpretation of bacteriological quality cannot be made on the basis of single samples.

Standard plate count was the only bacteriological analysis conducted on the treated and distributed water samples. No results were reported above the guideline.

INORGANIC & PHYSICAL

CHEMISTRY (FIELD)

It is desirable that the temperature of drinking water be less than 15°C. The palatability of water is enhanced by its coolness. A temperature below 15°C will tend to reduce the growth of nuisance organisms and hence minimize associated taste, colour, odour and corrosion problems. The temperature of the delivered water may increase in the distribution system due to the warming effect of the soil in late summer and fall and/or as a result of higher temperatures in the source water.

Field temperature exceeded the ODWO Maximum Desirable Concentration of 15°C in 4 of 18 treated and distributed water samples with a maximum reported value of 18.0°C.

CHEMISTRY (LAB)

The ODWOs indicate that a hardness level of between 80 and 100 mg/L as calcium carbonate for domestic waters provides an acceptable balance between corrosion and encrustation. Water supplies with a hardness greater than 200 mg/L are considered poor and would possess a tendency to form scale deposits and result in excessive soap consumption.

Hardness exceeded the ODWO Aesthetic or Recommended Operational Guideline of 80-100 mg/L in 18 of 18 treated and distributed water samples with a maximum reported value of 147.5 mg/L.

Total ammonium exceeded the European Economic Community Aesthetic Guideline Level of 0.05 mg/L in 17 of 18 treated and distributed water samples with a maximum reported value of 0.2 mg/L.

The Hamilton water treatment plant uses ammonia in the disinfection process and therefore, slightly elevated ammonia levels may be expected.

Turbidity in water is caused by the presence of suspended matter such as clay, silt, colloidal particles, plankton and other microscopic organisms. The most important potential health effect of turbidity is its interference with disinfection in the treatment plant and the maintenance of a chlorine residual. The ODWO Maximum Acceptable Concentration for turbidity is 1.0 Formazin Turbidity Units (FTU).

The lab turbidity exceeded the Maximum Acceptable Concentration in 1 treated water sample at 1.1 FTU but this was not confirmed by the corresponding field turbidity result which was considered more reliable.

METALS

At present, there is no evidence that aluminum is physiologically harmful and no health limit for drinking water has been specified. The measure of aluminum in treated water is important to indicate the efficiency of the treatment process. The ODWOs indicate that a useful guideline is to maintain a residual below 100 ug/L as aluminum in the water leaving the plant, to avoid problems in the distribution system.

Aluminum exceeded the ODWO Aesthetic or Recommended Operational Guideline of 100 ug/L in 7 of 18 treated and distributed water samples with a maximum reported value of 170.0 ug/L.

ORGANIC

CHLOROAROMATICS

Hexachlorobenzene, exceeded the World Health Organization Guideline Value of 10 ng/L in 1 distributed water sample with a reported value of 13.0 ng/L. All other sample results for hexachlorobenzene, which included 6 raw, 6 treated and 12 distributed, were below the detection level of 1 ng/L; therefore, this one positive value is considered anomalous.

Results of the other parameters in the chloroaromatic scan showed that none were detected above trace levels.

CHLOROPHENOLS

The results of the chlorophenol scan showed that none were detected.

POLYAROMATIC HYDROCARBONS (PAH)

The results of the PAH scan showed that none were detected in the treated and distributed water.

PESTICIDES & PCB

The results of the PCB scan showed that none were detected.

The results of the regular pesticide scan showed that none were detected above trace levels.

PHENOLICS

Phenolic compounds are present in the aquatic environment as a result of natural and/or industrial processes. The ODWOs recommend, as an operational guideline, that phenolic substances in drinking water not exceed 2.0 ug/L. This limit has been set primarily to prevent undesirable taste and odours, particularly in chlorinated water. No results exceeded the guideline.

SPECIFIC PESTICIDES

The results of the specific pesticides scan showed that none were detected.

VOLATILES

The detection of benzene, ethylbenzene, toluene and xylenes at low, trace levels may be a laboratory artifact derived from the analytical methodology.

Trihalomethanes (THMs) are produced during the water treatment process and will always occur in chlorinated waters. THMs are comprised of chloroform, chlorodibromomethane and dichlorobromomethane; bromoform occurs occasionally. Results are reported for the individual compounds as well as for total THMs. Only total THMs results are discussed.

Total THMs were found at positive levels in the 16 treated and distributed water samples analyzed with a maximum level of 31.1 ug/L. This was below the ODWO Maximum Acceptable Concentration of 350 ug/L.

CONCLUSIONS

The Hamilton water treatment plant, for the sample year 1990, produced good quality water and this was maintained in the distribution system.

One organic parameter, hexachlorobenzene, was reported above the World Health Organization guideline value in one sample. Since all other results (23 samples in the raw, treated and distributed water) were below the detection level, this one positive value is considered anomalous.

FIGURE 1

HAMILTON WTP

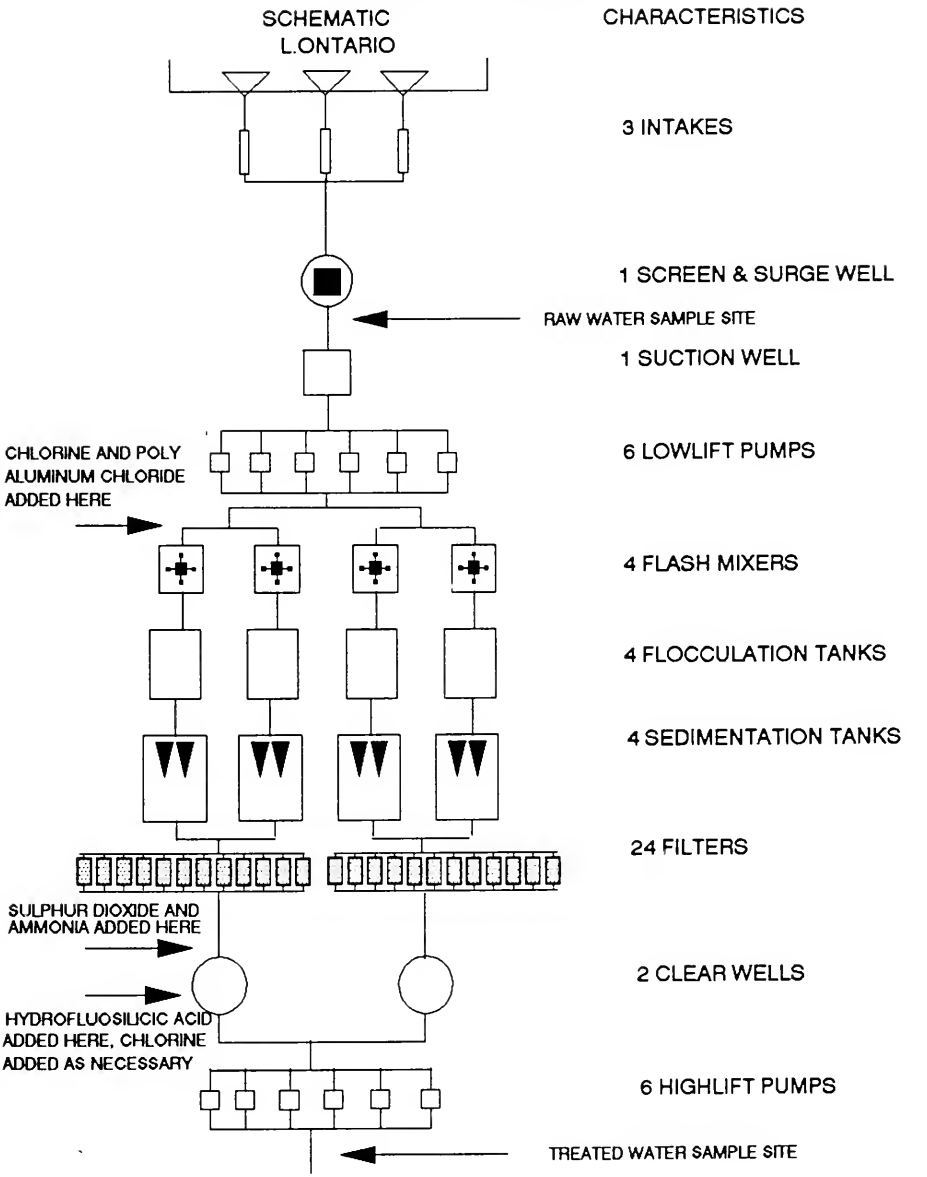

TABLE 1

DRINKING WATER SURVEILLANCE PROGRAM

PLANT GENERAL REPORT

WORKS #: 220003118
PLANT NAME: HAMILTON WATER SUPPLY SYSTEM

DISTRICT: HAMILTON
REGION: WEST CENTRAL
DISTRICT OFFICER: J.W. VOGT

UTM #:

PLANT SUPERINTENDENT: JIM HALLIDAY

ADDRESS: HAMILTON WATER SUPPLY SYSTEM
700 WOODWARD AVE
HAMILTON, ONT.
L8H 6P4
(Telephone) (416-526-4484)

MUNICIPALITY: HAMILTON
AUTHORITY: MUNICIPALITY

PLANT INFORMATION:

PLANTN VOLUME:	**-**	**(X 1000 M3)**
DESIGN CAPACITY:	**909**	**(X 1000 M3/DAY)**
RATED CAPACITY:	**-**	**(X 1000 M3/DAY)**

MUNICIPALITY:	POPULATION:
ANCASTER	16,542
DUNDAS TOWN	20,081
HAMILTON	307,690
STONEY CREEK	41,690
WATERDOWN	25,541

TABLE 2
DRINKING WATER SURVEILLANCE PROGRAM
IN-PLANT MONITORING

PARAMETER	LOCATION	FREQUENCY
FREE CHLORINE RESIDUAL	AFTER FILTERS	CONTINUOUS
	RAW WATER IN LAB	CONTINUOUS
	AFTER SETTLING TANKS	CONTINUOUS
	TREATED WATER	EVERY 2 HOURS
TOTAL CHLORINE RESIDUAL	TREATED WATER	EVERY 2 HOURS
PH	AFTER FILTERS	EVERY 2 HOURS
	RAW WATER IN LAB	EVERY 2 HOURS
	RAW WATER	CONTINUOUS
	TREATED WATER	CONTINUOUS
TEMPERATURE	RAW WATER	CONTINUOUS
	TREATED WATER	EVERY 2 HOURS
TURBIDITY	AFTER DISINFECTION	CONTINUOUS
	AFTER FILTERS	CONTINUOUS
	RAW WATER IN LAB	CONTINUOUS
	RAW WATER	EVERY 2 HOURS
	AFTER SETTLING TANKS	EVERY 2 HOURS
	TREATED WATER	CONTINUOUS

TABLE 3
DRINKING WATER SURVEILLANCE PROGRAM HAMILTON WSS SAMPLE DAY CONDITIONS FOR 1990

			TREATMENT CHEMICAL DOSAGE (MG/L)					
			PRE CHLORINATION	COAGULATION	COAGULATION	CHLORAMINATION	POST CHLORINATION	FLUORIDATION
DATE	DELAY * TIME(HRS)	FLOW (1000M3)	CHLORINE	ALUM LIQUID	POLY ALUMINUM CHLORIDE	AMMONIUM ANHYDROUS	CHLORINE	HYDROFLUOSILICIC ACID
JAN 23	3.00	203.545	1.90	8.00	1.60	.38	.28	
MAR 27	4.00	434.143	2.00		1.20	.31	1.18	.94
MAY 29	3.24	153.880	2.40		1.30	1.85	.20	1.25
JUL 24	.00	.000	2.50		1.23	.22	.47	1.07
SEP 26	4.00	178.727	2.10		1.20	.30		1.00
NOV 27	4.10	130.909	1.70		1.10	.30	.17	.99

* THE DELAY TIME BETWEEN THE RAW AND TREATED WATER SAMPLING, SHOULD ESTIMATE THE RETENTION TIME.

TABLE 4
DRINKING WATER SURVEILLANCE PROGRAM HAMILTON WSS
SUMMARY TABLE OF RESULTS (1990)

SCAN PARAMETER	RAW			TREATED			SITE 1			SITE 2			SITE 3		
	TOTAL	POSITIVE	TRACE	TOTAL	POSITIVE	TRACE	TOTAL	POSITIVE	TRACE	TOTAL	POSITIVE	TRACE	TOTAL	POSITIVE	TRACE
BACTERIOLOGICAL															
FECAL COLIFORM MF	6	5	0	.	.	.	.	.	.	.	.	.	.	.	.
STANDRD PLATE CNT MF	.	.	.	6	0	0	6	0	0	2	0	0	3	0	0
TOTAL COLIFORM MF	6	5	0	.	.	.	.	.	.	.	.	.	.	.	.
T COLIFORM BCKGRD MF	6	6	0	.	.	.	.	.	.	.	.	.	.	.	.
*TOTAL GROUP BACTERIOLOGICAL	18	16	0	6	0	0	6	0	0	2	0	0	3	0	0
CHEMISTRY (FLO)															
FLD CHLORINE (COMB)	.	.	.	6	6	0	12	12	0	2	2	0	6	6	0
FLD CHLORINE FREE	.	.	.	1	0	0	12	0	0	.	.	.	.	.	.
FLD CHLORINE (TOTAL)	.	.	.	6	6	0	12	12	0	2	2	0	6	6	0
FLD PH	1	1	0	1	1	0	11	11	0	4	4	0	8	8	0
FLD TEMPERATURE	6	6	0	6	6	0	10	10	0	4	4	0	8	8	0
FLD TURBIDITY	6	6	0	5	5	0	.	.	.	.	.	.	.	.	.
*TOTAL SCAN CHEMISTRY (FLD)	13	13	0	25	24	0	57	45	0	12	12	0	28	28	0
CHEMISTRY (LAB)															
ALKALINITY	6	6	0	6	6	0	12	12	0	4	4	0	8	8	0
CALCIUM	6	6	0	6	6	0	12	12	0	4	4	0	8	8	0
CYANIDE	6	0	0	6	0	1	.	.	.	.	.	.	.	.	.
CHLORIDE	6	6	0	6	6	0	12	12	0	4	4	0	8	8	0
COLOUR	6	0	5	6	0	5	12	0	12	4	0	4	8	0	4
CONDUCTIVITY	6	6	0	6	6	0	12	12	0	4	4	0	8	8	0
DISS ORG CARBON	6	6	0	6	6	0	12	12	0	4	4	0	8	8	0
FLUORIDE	6	6	0	6	6	0	12	12	0	4	4	0	8	8	0
HARDNESS	6	6	0	6	6	0	12	12	0	4	4	0	8	8	0
IONCAL	6	6	0	6	6	0	12	12	0	4	4	0	8	8	0
LANGELIERS INDEX	6	6	0	6	6	0	12	12	0	4	4	0	8	8	0
MAGNESIUM	6	6	0	6	6	0	12	12	0	4	4	0	8	8	0
SODIUM	6	6	0	6	6	0	12	12	0	4	4	0	8	8	0
AMMONIUM TOTAL	6	2	0	6	6	0	12	12	0	4	4	0	8	7	0
NITRITE	6	6	0	6	0	6	12	4	8	4	2	2	8	6	2
TOTAL NITRATES	6	6	0	6	6	0	12	12	0	4	4	0	8	8	0
NITROGEN TOT KJELD	6	6	0	6	6	0	12	12	0	4	4	0	8	8	0
PH	6	6	0	6	6	0	12	12	0	4	4	0	8	8	0
PHOSPHORUS FIL REACT	6	1	4	6	1	5	.	.	.	.	.	.	.	.	.
PHOSPHORUS TOTAL	6	5	1	6	3	3	.	.	.	.	.	.	.	.	.
SULPHATE	6	6	0	6	6	0	12	12	0	4	4	0	8	8	0
TURBIDITY	6	6	0	6	6	0	12	12	0	4	4	0	8	8	0
*TOTAL SCAN CHEMISTRY (LAB)	132	110	10	132	106	20	228	208	20	76	70	6	152	141	6

TABLE 4
DRINKING WATER SURVEILLANCE PROGRAM HAMILTON WSS
SUMMARY TABLE OF RESULTS (1990)

SCAN PARAMETER	SITE RAW TOTAL	RAW POSITIVE	RAW TRACE	TREATED TOTAL	TREATED POSITIVE	TREATED TRACE	SITE 1 TOTAL	SITE 1 POSITIVE	SITE 1 TRACE	SITE 2 TOTAL	SITE 2 POSITIVE	SITE 2 TRACE	SITE 3 TOTAL	SITE 3 POSITIVE	SITE 3 TRACE
METALS															
SILVER	6	0	0	6	0	1	12	0	0	4	0	0	8	0	0
ALUMINUM	6	6	0	6	6	0	12	12	0	4	4	0	8	8	0
ARSENIC	6	0	6	6	2	4	12	3	9	4	0	4	8	6	2
BARIUM	6	6	0	6	6	0	12	12	0	4	4	0	8	8	0
BORON	6	6	0	6	6	0	12	12	0	4	4	0	8	8	0
BERYLLIUM	6	0	0	6	0	0	12	0	0	4	0	0	8	0	1
CADMIUM	6	0	2	6	0	1	12	0	1	4	0	2	8	0	0
COBALT	6	0	5	6	0	5	12	0	8	4	0	2	8	0	8
CHROMIUM	6	0	6	6	0	6	12	0	12	4	0	4	8	0	8
COPPER	6	0	6	6	0	6	12	6	6	4	4	0	8	8	0
IRON	6	2	4	6	0	2	12	0	12	4	0	1	8	0	0
MERCURY	6	0	0	6	0	0	.	.	.	.	.	.	.	.	.
MANGANESE	6	6	0	6	5	1	12	12	0	4	3	1	8	6	2
MOLYBDENUM	6	6	0	6	6	0	12	12	0	4	4	0	8	8	0
NICKEL	6	1	5	6	0	6	12	1	11	4	1	2	8	0	8
LEAD	6	1	5	6	0	3	12	12	0	4	3	1	8	8	0
ANTIMONY	6	5	1	6	1	5	12	11	1	4	4	0	8	8	0
SELENIUM	6	0	0	6	0	2	12	0	7	4	0	2	8	0	6
STRONTIUM	6	6	0	6	6	0	12	12	0	4	4	0	8	8	0
TITANIUM	6	1	5	6	0	6	12	1	11	4	0	4	8	2	6
THALLIUM	6	0	0	6	0	0	12	0	0	4	0	0	8	0	0
URANIUM	6	0	6	6	0	6	12	0	12	4	0	4	8	0	8
VANADIUM	6	1	5	6	1	5	12	1	11	4	1	3	8	0	8
ZINC	6	6	0	6	2	4	12	10	2	4	4	0	8	8	0
*TOTAL SCAN METALS	144	53	56	144	41	63	276	117	103	92	40	30	184	86	57
*TOTAL GROUP INORGANIC & PHYSICAL	289	176	66	301	171	83	561	370	123	180	122	36	364	255	63
CHLOROAROMATICS															
HEXACHLOROBUTADIENE	6	0	0	6	0	0	6	0	0	2	0	0	4	0	0
123 TRICHLOROBENZENE	6	0	0	6	0	0	6	0	0	2	0	0	4	0	0
1234 T-CHLOROBENZENE	6	0	0	6	0	0	6	0	0	2	0	0	4	0	0
1235 T-CHLOROBENZENE	6	0	0	6	0	0	6	0	0	2	0	0	4	0	0
124 TRICHLOROBENZENE	6	0	0	6	0	0	6	0	0	2	0	0	4	0	0
1245 T-CHLOROBENZENE	6	0	0	6	0	0	6	0	0	2	0	0	4	0	0
135 TRICHLOROBENZENE	6	0	0	6	0	0	6	0	0	2	0	0	4	0	0
HCB	6	0	0	6	0	0	6	1	0	2	0	0	4	0	0
HEXACHLOROETHANE	6	0	1	6	0	1	6	0	0	2	0	0	4	0	0
OCTACHLORODSTYRENE	6	0	0	6	0	0	6	0	0	2	0	0	4	0	0
PENTACHLOROBENZENE	6	0	0	6	0	0	6	0	0	2	0	0	4	0	0
236 TRICHLOROTOLUENE	6	0	0	6	0	0	6	0	0	2	0	0	4	0	0
245 TRICHLOROTOLUENE	6	0	0	6	0	0	6	0	0	2	0	0	4	0	0
26A TRICHLOROTOLUENE	6	0	0	6	0	0	6	0	0	2	0	0	4	0	0
*TOTAL SCAN CHLOROAROMATICS	84	0	1	84	0	1	84	1	0	28	0	0	56	0	0
CHLOROPHENOLS															

TABLE 4
DRINKING WATER SURVEILLANCE PROGRAM HAMILTON WSS
SUMMARY TABLE OF RESULTS (1990)

SCAN PARAMETER	SITE RAW TOTAL	RAW POSITIVE	RAW TRACE	TREATED TOTAL	TREATED POSITIVE	TREATED TRACE	SITE 1 TOTAL	SITE 1 POSITIVE	SITE 1 TRACE	SITE 2 TOTAL	SITE 2 POSITIVE	SITE 2 TRACE	SITE 3 TOTAL	SITE 3 POSITIVE	SITE 3 TRACE
234 TRICHLOROPHENOL	2	0	0	2	0	0	.	.	.	.	.	.	.	.	.
2345 T-CHLOROPHENOL	2	0	0	2	0	0	.	.	.	.	.	.	.	.	.
2356 T-CHLOROPHENOL	2	0	0	2	0	0	.	.	.	.	.	.	.	.	.
245-TRICHLOROPHENOL	2	0	0	2	0	0	.	.	.	.	.	.	.	.	.
246-TRICHLOROPHENOL	2	0	0	2	0	0	.	.	.	.	.	.	.	.	.
PENTACHLOROPHENOL	2	0	0	2	0	0	.	.	.	.	.	.	.	.	.
*TOTAL SCAN CHLOROPHENOLS	12	0	0	12	0	0	0	0	0	0	0	0	0	0	0
PAH															
PHENANTHRENE	6	0	0	6	0	0	1	0	0	.	.	.	1	0	0
ANTHRACENE	6	0	0	6	0	0	1	0	0	.	.	.	1	0	0
FLUORANTHENE	6	0	0	6	0	0	1	0	0	.	.	.	1	0	0
PYRENE	6	0	0	6	0	0	1	0	0	.	.	.	1	0	0
BENZO(A)ANTHRACENE	6	0	0	6	0	0	1	0	0	.	.	.	1	0	0
CHRYSENE	6	0	0	6	0	0	1	0	0	.	.	.	1	0	0
DIMETH. BENZ(A)ANTHR	6	0	0	6	0	0	1	0	0	.	.	.	1	0	0
BENZO(E) PYRENE	6	0	0	6	0	0	1	0	0	.	.	.	1	0	0
BENZO(B) FLUORANTHEN	6	0	0	6	0	0	1	0	0	.	.	.	1	0	0
PERYLENE	6	0	0	6	0	0	1	0	0	.	.	.	1	0	0
BENZO(K) FLUORANTHEN	6	0	1	6	0	0	1	0	0	.	.	.	1	0	0
BENZO(A) PYRENE	6	0	0	6	0	0	1	0	0	.	.	.	1	0	0
BENZO(G,H,I) PERYLEN	6	0	0	6	0	0	1	0	0	.	.	.	1	0	0
DIBENZO(A,H) ANTHRAC	6	0	0	6	0	0	1	0	0	.	.	.	1	0	0
INDENO(1,2,3-C,D) PY	6	0	0	6	0	0	1	0	0	.	.	.	1	0	0
BENZO(B) CHRYSENE	6	0	0	6	0	0	1	0	0	.	.	.	1	0	0
CORONENE	6	0	0	6	0	0	1	0	0	.	.	.	1	0	0
*TOTAL SCAN PAH	102	0	1	102	0	0	17	0	0	0	0	0	17	0	0
PESTICIDES & PCB															
ALDRIN	6	0	0	6	0	0	6	0	0	2	0	0	4	0	0
ALPHA BHC	6	0	5	6	0	6	6	0	5	2	0	2	4	0	4
BETA BHC	6	0	0	6	0	0	6	0	0	2	0	0	4	0	0
LINDANE	6	0	0	6	0	1	6	0	1	2	0	1	4	0	0
ALPHA CHLORDANE	6	0	0	6	0	0	6	0	0	2	0	0	4	0	0
GAMMA CHLORDANE	6	0	0	6	0	0	6	0	0	2	0	0	4	0	0
DIELDRIN	6	0	0	6	0	0	6	0	0	2	0	0	4	0	0
METHOXYCHLOR	6	0	0	6	0	0	6	0	0	2	0	0	4	0	0
ENDOSULFAN 1	6	0	0	6	0	0	6	0	0	2	0	0	4	0	0
ENDOSULFAN II	6	0	0	6	0	0	6	0	0	2	0	0	4	0	0
ENDRIN	6	0	0	6	0	0	6	0	0	2	0	0	4	0	0
ENDOSULFAN SULPHATE	6	0	0	6	0	0	6	0	0	2	0	0	4	0	0
HEPTACHLOR EPOXIDE	6	0	0	6	0	0	6	0	0	2	0	0	4	0	0
HEPTACHLOR	6	0	0	6	0	0	6	0	0	2	0	0	4	0	0
MIREX	6	0	0	6	0	0	6	0	0	2	0	0	4	0	0
OXYCHLORDANE	6	0	0	6	0	0	6	0	0	2	0	0	4	0	0
OPDDT	6	0	0	6	0	0	6	0	0	2	0	0	4	0	0
PCB	6	0	0	6	0	0	6	0	0	2	0	0	4	0	0
ODD	6	0	0	6	0	0	6	0	0	2	0	0	4	0	0
PPDDE	6	0	0	6	0	0	6	0	0	2	0	0	4	0	0

TABLE 4
DRINKING WATER SURVEILLANCE PROGRAM HAMILTON WSS
SUMMARY TABLE OF RESULTS (1990)

SCAN PARAMETER	SITE RAW TOTAL	RAW POSITIVE	RAW TRACE	TREATED TOTAL	TREATED POSITIVE	TREATED TRACE	SITE 1 TOTAL	SITE 1 POSITIVE	SITE 1 TRACE	SITE 2 TOTAL	SITE 2 POSITIVE	SITE 2 TRACE	SITE 3 TOTAL	SITE 3 POSITIVE	SITE 3 TRACE
PPDDT	6	0	0	6	0	0	6	0	0	2	0	0	4	0	0
AMETRINE	6	0	0	5	0	0	.	.	.	.	.	.	.	.	.
ATRAZINE	6	0	1	5	0	2	.	.	.	.	.	.	.	.	.
ATRATONE	6	0	0	5	0	0	.	.	.	.	.	.	.	.	.
CYANAZINE (BLADEX)	6	0	0	5	0	0	.	.	.	.	.	.	.	.	.
DESETHYLATRAZINE	6	0	0	5	0	0	.	.	.	.	.	.	.	.	.
D-ETHYL SIMAZINE	6	0	0	5	0	0	.	.	.	.	.	.	.	.	.
PROMETONE	6	0	0	5	0	0	.	.	.	.	.	.	.	.	.
PROPAZINE	6	0	0	5	0	0	.	.	.	.	.	.	.	.	.
PROMETRYNE	6	0	0	5	0	0	.	.	.	.	.	.	.	.	.
METRIBUZIN (SENCOR)	5	0	0	5	0	0	.	.	.	.	.	.	.	.	.
SIMAZINE	6	0	0	5	0	0	.	.	.	.	.	.	.	.	.
ALACHLOR (LASSO)	6	0	0	5	0	0	.	.	.	.	.	.	.	.	.
METOLACHLOR	6	0	0	5	0	0	.	.	.	.	.	.	.	.	.
HEXACLCYCLOPENTADIEN	1	0	0	1	0	0	1	0	0	.	.	.	1	0	0
*TOTAL SCAN PESTICIDES & PCB	204	0	6	192	0	9	127	0	6	42	0	3	85	0	4
PHENOLICS															
PHENOLICS	6	0	1	6	1	3	.	.	.	.	.	.	.	.	.
*TOTAL SCAN PHENOLICS	6	0	1	6	1	3	0	0	0	0	0	0	0	0	0
SPECIFIC PESTICIDES															
TOXAPHENE	6	0	0	6	0	0	6	0	0	2	0	0	4	0	0
2,4,5-T	2	0	0	2	0	0	.	.	.	.	.	.	.	.	.
2,4-D	2	0	0	2	0	0	.	.	.	.	.	.	.	.	.
2,4-DB	2	0	0	2	0	0	.	.	.	.	.	.	.	.	.
2,4 D PROPIONIC ACID	2	0	0	2	0	0	.	.	.	.	.	.	.	.	.
DICAMBA	2	0	0	2	0	0	.	.	.	.	.	.	.	.	.
PICHLORAM	0	0	0	0	0	0	.	.	.	.	.	.	.	.	.
SILVEX	2	0	0	2	0	0	.	.	.	.	.	.	.	.	.
DIAZINON	2	0	0	2	0	0	.	.	.	.	.	.	.	.	.
DICHLOROVOS	2	0	0	2	0	0	.	.	.	.	.	.	.	.	.
CHLORPYRIFOS	2	0	0	2	0	0	.	.	.	.	.	.	.	.	.
ETHION	2	0	0	2	0	0	.	.	.	.	.	.	.	.	.
AZINPHOS-METHYL	0	0	0	0	0	0	.	.	.	.	.	.	.	.	.
MALATHION	2	0	0	2	0	0	.	.	.	.	.	.	.	.	.
MEVINPHOS	2	0	0	2	0	0	.	.	.	.	.	.	.	.	.
METHYL PARATHION	2	0	0	2	0	0	.	.	.	.	.	.	.	.	.
METHYLTRITHION	2	0	0	2	0	0	.	.	.	.	.	.	.	.	.
PARATHION	2	0	0	2	0	0	.	.	.	.	.	.	.	.	.
PHORATE	2	0	0	2	0	0	.	.	.	.	.	.	.	.	.
RELDAN	2	0	0	2	0	0	.	.	.	.	.	.	.	.	.
RONNEL	2	0	0	2	0	0	.	.	.	.	.	.	.	.	.
AMINOCARB	0	0	0	0	0	0	.	.	.	.	.	.	.	.	.
BENONYL	0	0	0	0	0	0	.	.	.	.	.	.	.	.	.
BUX	0	0	0	0	0	0	.	.	.	.	.	.	.	.	.
CARBOFURAN	2	0	0	2	0	0	.	.	.	.	.	.	.	.	.
CICP	2	0	0	2	0	0	.	.	.	.	.	.	.	.	.
DIALLATE	2	0	0	2	0	0	.	.	.	.	.	.	.	.	.

TABLE 4
DRINKING WATER SURVEILLANCE PROGRAM HAMILTON WSS
SUMMARY TABLE OF RESULTS (1990)

SCAN PARAMETER	SITE RAW TOTAL	RAW POSITIVE	RAW TRACE	TREATED TOTAL	TREATED POSITIVE	TREATED TRACE	SITE 1 TOTAL	SITE 1 POSITIVE	SITE 1 TRACE	SITE 2 TOTAL	SITE 2 POSITIVE	SITE 2 TRACE	SITE 3 TOTAL	SITE 3 POSITIVE	SITE 3 TRACE
EPTAM	2	0	0	2	0	0	.	.	.	.	.	.	.	.	.
IPC	2	0	0	2	0	0	.	.	.	.	.	.	.	.	.
PROPOXUR	2	0	0	2	0	0	.	.	.	.	.	.	.	.	.
CARBARYL	2	0	0	2	0	0	.	.	.	.	.	.	.	.	.
BUTYLATE	2	0	0	2	0	0	.	.	.	.	.	.	.	.	.
*TOTAL SCAN SPECIFIC PESTICIDES	58	0	0	58	0	0	6	0	0	2	0	0	4	0	0
VOLATILES															
BENZENE	6	0	0	6	0	1	5	0	3	1	0	0	4	0	0
TOLUENE	6	0	0	6	0	1	5	0	4	1	0	0	4	0	1
ETHYLBENZENE	6	0	0	6	0	3	5	0	3	1	0	0	4	0	1
P-XYLENE	6	0	0	6	0	0	5	0	0	1	0	0	4	0	0
M-XYLENE	6	0	0	6	0	0	5	0	0	1	0	0	4	0	0
O-XYLENE	6	0	0	6	0	0	5	0	0	1	0	0	4	0	0
STYRENE	6	0	1	6	0	3	5	0	3	1	0	1	4	0	1
1,1 DICHLOROETHYLENE	6	0	0	6	0	0	5	0	0	1	0	0	4	0	0
METHYLENE CHLORIDE	6	0	0	6	0	0	5	0	0	1	0	0	4	0	0
T1,2DICHLOROETHYLENE	6	0	0	6	0	0	5	0	0	1	0	0	4	0	0
1,1 DICHLOROETHANE	6	0	0	6	0	0	5	0	0	1	0	0	4	0	0
CHLOROFORM	6	0	0	6	6	0	5	5	0	1	1	0	4	4	0
111, TRICHLOROETHANE	6	0	0	6	0	0	5	0	0	1	0	0	4	0	0
1,2 DICHLOROETHANE	6	0	0	6	0	0	5	0	0	1	0	0	4	0	0
CARBON TETRACHLORIDE	6	0	0	6	0	0	5	0	0	1	0	0	4	0	0
1,2 DICHLOROPROPANE	6	0	0	6	0	0	5	0	0	1	0	0	4	0	0
TRICHLOROETHYLENE	6	0	0	6	0	0	5	0	0	1	0	0	4	0	0
DICHLOROBROMOMETHANE	6	0	0	6	6	0	5	5	0	1	1	0	4	4	0
112 TRICHLOROETHANE	6	0	0	6	0	0	5	0	0	1	0	0	4	0	0
CHLORODIBROMOMETHANE	6	0	0	6	6	0	5	5	0	1	1	0	4	4	0
T-CHLOROETHYLENE	6	0	0	6	0	0	5	0	0	1	0	0	4	0	0
BROMOFORM	6	0	0	6	0	6	5	0	5	1	0	1	4	0	4
1122 T-CHLOROETHANE	6	0	0	6	0	0	5	0	0	1	0	0	4	0	0
CHLOROBENZENE	6	0	0	6	0	0	5	0	0	1	0	0	4	0	0
1,4 DICHLOROBENZENE	6	0	0	6	0	0	5	0	0	1	0	0	4	0	0
1,3 DICHLOROBENZENE	6	0	0	6	0	0	5	0	0	1	0	0	4	0	0
1,2 DICHLOROBENZENE	6	0	0	6	0	0	5	0	0	1	0	0	4	0	0
ETHLYENE DIBROMIDE	6	0	0	6	0	0	5	0	0	1	0	0	4	0	0
TOTL TRIHALOMETHANES	6	0	0	6	6	0	5	5	0	1	1	0	4	4	0
*TOTAL SCAN VOLATILES	174	0	1	174	24	14	145	20	18	29	4	2	116	16	7
*TOTAL GROUP ORGANIC	640	0	10	628	25	27	379	21	24	101	4	5	278	16	11

KEY TO TABLE 5 and 6

A ONTARIO DRINKING WATER OBJECTIVES (ODWO)
1. Maximum Acceptable Concentration (MAC)
1+. MAC for Total Trihalomethanes
2. Interim Maximum Acceptable Concentration (IMAC)
3. Aesthetic Objective (AO)
3*. AO for Total Xylenes
4. Recommended Operational Guideline

B HEALTH & WELFARE CANADA (H&W)
1. Maximum Acceptable Concentration (MAC)
2. Proposed MAC
3. Interim MAC
4. Aesthetic Objective (AO)

C WORLD HEALTH ORGANIZATION (WHO)
1. Guideline Value (GV)
2. Tentative GV
3. Aesthetic GV

D US ENVIRONMENTAL PROTECTION AGENCY (EPA)
1. Maximum Contaminant Level (MCL)
2. Suggested No-Adverse Effect Level (SNAEL)
3. Lifetime Health Advisory
4. EPA Ambient Water Quality Criteria
4T. EPA Ambient Water Quality Criteria for Total PAH

F EUROPEAN ECONOMIC COMMUNITY (EEC)
1. Health Related Guideline Level
2. Aesthetic Guideline Level
3. Maximum Admissable Concentration (MADC)

G CALIFORNIA STATE DEPARTMENT OF HEALTH-GUIDELINE VALUE

I NEW YORK STATE AMBIENT WATER GUIDELINE

N/A NONE AVAILABLE

LABORATORY RESULTS, REMARK DESCRIPTIONS

.	No Sample Taken
BDL	Below Minimum Measurement Amount
<T	Greater Than Detection Limit But Not Confident (SEE INTERPRETATION OF RESULTS ABOVE)
>	Results Are Greater Than The Upper Limit
<=>	Approximate Result
!CS	No Data: Contamination Suspected
!IL	No Data: Sample Incorrectly Labelled
!IS	No Data: Insufficient Sample
!IV	No Data: Inverted Septum
!LA	No Data: Laboratory Accident
!LD	No Data: Test Queued After Sample Discarded
!NA	No Data: No Authorization To Perform Reanalysis
!NP	No Data: No Procedure
!NR	No Data: Sample Not Received
!OP	No Data: Obscured Plate
!QU	No Data: Quality Control Unacceptable
!PE	No Data: Procedural Error - Sample Discarded
!PH	No Data: Sample pH Outside Valid Range
!RE	No Data: Received Empty
!RO	No Data: See Attached Report (no numeric results)
!SM	No Data: Sample Missing
!SS	No Data: Send Separate Sample Properly Preserved
!UI	No Data: Indeterminant Interference
!TX	No Data: Time Expired
A3C	Approximate, Total Count Exceeded 300 Colonies
APL	Additional Peak, Large, Not Priority Pollutant
APS	Additional Peak, Less Than, Not Priority Pollutant
CIC	Possible Contamination, Improper Cap
CRO	Calculated Result Only
PPS	Test Performed On Preserved Sample
RMP	P and M-Xylene Not Separated
RRV	Rerun Verification
RVU	Reported Value Unusual
SPS	Several Peaks, Small, Not Priority Pollutant

UCR		Unreliable: Could Not Confirm By Reanalysis
UCS		Unreliable: Contamination Suspected
UIN		Unreliable: Indeterminate Interference
XP		Positive After X Number Of Hours
T#	(T06)	Result Taken After # Hours

TABLE 5
DRINKING WATER SURVEILLANCE PROGRAM HAMILTON WSS 1990

		WATER TREATMENT PLANT		DISTRIBUTION SYSTEM			
	RAW	TREATED	SITE 1		SITE 2		SITE 3
		STANDING	FREE FLOW	STANDING	FREE FLOW	STANDING	FREE FLOW
BACTERIOLOGICAL							
FECAL COLIFORM MF (CT/100ML)		DET'N LIMIT = 0		GUIDELINE = 0 (A1)			
JAN	17	.	.	.	.	.	.
MAR	5	.	.	.	.	.	.
MAY	BDL	.	.	.	.	.	.
JUL	2	.	.	.	.	.	.
SEP	2	.	.	.	.	.	.
NOV	5	.	.	.	.	.	.
STANDRD PLATE CNT MF (COUNTS/ML)		DET'N LIMIT = 0		GUIDELINE = 500/ML (A3)			
JAN	.	0 <=>	.	0 <=>	.	0 <=>	.	.
MAR	.	1 <=>	.	0 <=>	.	1 <=>	.	.
MAY	.	4 <=>	.	1 <=>	.	.	.	.
JUL	.	2 <=>	.	1 <=>	.	.	.	0 <=>
SEP	.	0 <=>	.	7 <=>	.	.	.	0 <=>
NOV	.	2 <=>	.	3 <=>	.	.	.	0 <=>
TOTAL COLIFORM MF (CT/100ML)		DET'N LIMIT = 0		GUIDELINE = 5/100ML(A1)			
JAN	2060	.	.	.	.	.	.
MAR	26	.	.	.	.	.	.
MAY	10 <=>	.	.	.	.	.	.
JUL	8	.	.	.	.	.	.
SEP	16	.	.	.	.	.	.
NOV	124	.	.	.	.	.	.
T COLIFORM BCKGRD MF (CT/100ML)		DET'N LIMIT = 0		GUIDELINE = N/A			
JAN	4200	.	.	.	.	.	.
MAR	104	.	.	.	.	.	.
MAY	260	.	.	.	.	.	.
JUL	8400	.	.	.	.	.	.
SEP	1480	.	.	.	.	.	.
NOV	800	.	.	.	.	.	.

TABLE 5
DRINKING WATER SURVEILLANCE PROGRAM HAMILTON WSS 1990

SITE TYPE	WATER TREATMENT PLANT		DISTRIBUTION SYSTEM					
	RAW	TREATED	SITE 1		SITE 2		SITE 3	
			STANDING	FREE FLOW	STANDING	FREE FLOW	STANDING	FREE FLOW
CHEMISTRY (FLD)								
FLD CHLORINE (COMB) (MG/L)			DET'N LIMIT = 0	GUIDELINE = N/A				
JAN	.	1.200	.100	1.300	.	.900	.	.
MAR	.	1.180	.300	1.300	.	1.100	.	.
MAY	.	1.290	.700	1.500	.	.	.	1.100
JUL	.	1.150	.100	1.200	.	.	.300	.900
SEP	.	1.240	.500	1.300	.	.	.200	.500
NOV	.	1.180	.100	1.300	.	.	.	.700
FLD CHLORINE FREE (MG/L)			DET'N LIMIT = 0	GUIDELINE = N/A				
JAN	.	.	.000	.000	.	.	.	.
MAR	.	.	.000	.000	.	.	.	.
MAY	.	.	.000	.000	.	.	.	.
JUL	.	.	.000	.000	.	.	.	.
SEP	.	.	.000	.000	.	.	.	.
NOV	.	.000	.000	.000	.	.	.	.
FLD CHLORINE (TOTAL) (MG/L)			DET'N LIMIT = 0	GUIDELINE = N/A				
JAN	.	1.200	.100	1.300	.	.900	.	.
MAR	.	1.180	.300	1.300	.	1.100	.	.
MAY	.	1.290	.700	1.500	.	.	.	1.100
JUL	.	1.150	.100	1.200	.	.	.300	.900
SEP	.	1.240	.500	1.300	.	.	.200	.500
NOV	.	1.180	.100	1.300	.	.	.	.700
FLD PH (DMNSLESS)			DET'N LIMIT = N/A	GUIDELINE = 6.5-8.5(A4)				
JAN	.	.	7.600	.	7.000	7.200	.	.
MAR	.	.	7.600	7.800	7.600	7.600	.	.
MAY	.	.	7.700	7.700	.	.	7.400	7.400
JUL	.	.	7.600	7.800	.	.	7.600	7.800
SEP	.	.	7.200	7.600	.	.	7.400	7.600
NOV	7.900	7.500	7.600	7.800	.	.	7.200	7.600
FLD TEMPERATURE (DEG.C)			DET'N LIMIT = N/A	GUIDELINE = 15 (A3)				
JAN	4.000	4.000	11.000	4.000	16.000	7.000	.	.
MAR	6.000	6.000	.	6.000	18.000	8.000	.	.
MAY	11.000	11.000	24.000	12.000	.	.	15.000	10.000
JUL	18.000	18.000	.	18.000	.	.	23.000	17.000
SEP	8.000	8.000	20.000	15.000	.	.	20.000	18.000
NOV	8.500	8.500	15.000	10.000	.	.	18.000	10.000

TABLE 5
DRINKING WATER SURVEILLANCE PROGRAM HAMILTON WSS 1990

SITE TYPE		WATER TREATMENT PLANT		DISTRIBUTION SYSTEM					
	RAW	TREATED	SITE 1		SITE 2		SITE 3		
			STANDING	FREE FLOW	STANDING	FREE FLOW	STANDING	FREE FLOW	
FLD TURBIDITY (FTU)			DET'N LIMIT = N/A		GUIDELINE = 1 (A1)				
JAN	30.000	.160	.	.	.	.	.	.	
MAR	1.000	.040	.	.	.	.	.	.	
MAY	1.700	.240	.	.	.	.	.	.	
JUL	.900	.310	.	.	.	.	.	.	
SEP	1.300	.	.	.	.	.	.	.	
NOV	2.500	.090	.	.	.	.	.	.	

TABLE 5
DRINKING WATER SURVEILLANCE PROGRAM HAMILTON WSS 1990

SITE TYPE	WATER TREATMENT PLANT RAW	WATER TREATMENT PLANT TREATED	DISTRIBUTION SYSTEM SITE 1 STANDING	SITE 1 FREE FLOW	SITE 2 STANDING	SITE 2 FREE FLOW	SITE 3 STANDING	SITE 3 FREE FLOW
CHEMISTRY (LAB)								
ALKALINITY (MG/L)			DET'N LIMIT = 0.2	GUIDELINE = 30-500 (A4)				
JAN	102.800	94.500	98.000	96.600	97.700	97.700	.	.
MAR	101.700	96.500	95.000	95.600	96.000	96.500	.	.
MAY	103.700	99.000	98.900	99.200	.	.	96.500	95.100
JUL	101.300	96.300	97.000	96.300	.	.	97.900	98.500
SEP	101.600	95.700	97.100	96.800	.	.	94.400	92.100
NOV	102.000	97.000	96.700	96.800	.	.	97.900	97.200
CALCIUM (MG/L)			DET'N LIMIT = 0.2	GUIDELINE = 100 (F2)				
JAN	40.800	40.600	39.600	40.800	39.500	40.400	.	.
MAR	43.000	43.600	42.200	42.600	42.400	41.600	.	.
MAY	41.600	42.000	42.100	42.000	.	.	39.900	39.300
JUL	41.400	41.800	41.700	42.700	.	.	43.200	43.600
SEP	43.400	42.400	44.200	42.600	.	.	41.600	41.400
NOV	44.300	44.200	42.400	44.000	.	.	43.200	43.100
CYANIDE (MG/L)			DET'N LIMIT = 0.001	GUIDELINE = .2 (A1)				
JAN	BDL	.002 <T	.	.	.	.	.	.
MAR	BDL	BDL	.	.	.	.	.	.
MAY	BDL	BDL	.	.	.	.	.	.
JUL	BDL	BDL	.	.	.	.	.	.
SEP	BDL	BDL	.	.	.	.	.	.
NOV	BDL	BDL	.	.	.	.	.	.
CHLORIDE (MG/L)			DET'N LIMIT = 0.2	GUIDELINE = 250 (A3)				
JAN	24.700	26.900	26.700	26.700	27.100	26.900	.	.
MAR	28.500	28.900	26.100	26.600	29.700	29.000	.	.
MAY	24.400	27.100	27.700	27.100	.	.	28.000	28.200
JUL	24.600	28.600	27.100	27.700	.	.	26.500	26.800
SEP	23.900	26.300	26.100	26.500	.	.	24.300	24.700
NOV	23.400	26.500	25.000	25.800	.	.	24.900	24.800
COLOUR (HZU)			DET'N LIMIT = 0.5	GUIDELINE = 5 (A3)				
JAN	BDL	1.000 <T	1.500 <T	1.500 <T	1.000 <T	1.000 <T	.	.
MAR	2.000 <T	1.000 <T	1.000 <T	1.000 <T	1.000 <T	.500 <T	.	.
MAY	2.000 <T	.500 <T	1.000 <T	1.000 <T	.	.	BDL	BDL
JUL	1.500 <T	.500 <T	1.000 <T	1.000 <T	.	.	1.000 <T	1.000 <T
SEP	1.500 <T	.500 <T	1.000 <T	1.000 <T	.	.	1.000 <T	.500 <T
NOV	1.500 <T	BDL	.500 <T	1.000 <T	.	.	BDL	BDL

TABLE 5
DRINKING WATER SURVEILLANCE PROGRAM HAMILTON WSS 1990

SITE TYPE	WATER TREATMENT PLANT		DISTRIBUTION SYSTEM					
	RAW	TREATED	SITE 1		SITE 2		SITE 3	
			STANDING	FREE FLOW	STANDING	FREE FLOW	STANDING	FREE FLOW
CONDUCTIVITY (UMHO/CM)			DET'N LIMIT = 1.		GUIDELINE = 400 (F2)			
JAN	333	340	338	341	341	340	.	.
MAR	354	348	333	337	344	349	.	.
MAY	339	344	349	346	.	.	409	340
JUL	334	343	333	341	.	.	338	338
SEP	328	335	338	337	.	.	329	326
NOV	335	342	335	347	.	.	335	335
DISS ORG CARBON (MG/L)			DET'N LIMIT = .100		GUIDELINE = 5.0 (A3)			
JAN	1.800	1.600	1.700	1.600	1.700	1.700	.	.
MAR	2.000	1.900	1.800	1.800	1.700	1.700	.	.
MAY	2.000	2.100	2.200	2.200	.	.	2.100	2.100
JUL	2.000	2.100	2.100	2.000	.	.	1.900	2.300
SEP	1.600	1.600	1.600	1.900	.	.	1.800	1.900
NOV	1.900	1.900	1.800	1.800	.	.	1.700	1.700
FLUORIDE (MG/L)			DET'N LIMIT = 0.01		GUIDELINE = 2.4 (A1)			
JAN	.120	1.240	.260	.780	.540	.520	.	.
MAR	.160	.980	1.160	1.280	1.260	1.240	.	.
MAY	.120	.960	1.280	1.080	.	.	1.160	1.160
JUL	.160	1.080	.320	.940	.	.	.740	.740
SEP	.120	1.300	1.160	1.120	.	.	1.140	1.140
NOV	.140	1.020	1.180	1.180	.	.	1.140	1.140
HARDNESS (MG/L)			DET'N LIMIT = 0.5		GUIDELINE = 80-100 (A4)			
JAN	137.000	136.000	134.000	136.000	133.000	135.000	.	.
MAR	144.000	145.000	141.000	142.000	142.000	140.000	.	.
MAY	140.400	141.000	141.200	140.700	.	.	135.200	133.600
JUL	138.500	138.600	137.900	141.600	.	.	143.600	144.500
SEP	144.000	141.000	146.000	142.000	.	.	139.000	140.000
NOV	147.100	147.500	142.200	146.600	.	.	144.400	144.200
IONCAL (DMNSLESS)			DET'N LIMIT = N/A		GUIDELINE = N/A			
JAN	2.484	.914	3.588	1.468	4.155	2.256	.	.
MAR	.453	3.643	3.861	3.235	1.644	.773	.	.
MAY	.523	2.144	2.428	1.840	.	.	.643	1.070
JUL	1.541	2.306	1.126	3.873	.	.	4.754	4.991
SEP	3.119	2.897	5.462	2.810	.	.	4.335	5.185
NOV	5.521	6.928	4.415	7.526	.	.	5.084	6.050

TABLE 5
DRINKING WATER SURVEILLANCE PROGRAM HAMILTON WSS 1990

SITE TYPE	RAW	TREATED	WATER TREATMENT PLANT SITE 1 STANDING	WATER TREATMENT PLANT SITE 1 FREE FLOW	DISTRIBUTION SYSTEM SITE 2 STANDING	DISTRIBUTION SYSTEM SITE 2 FREE FLOW	DISTRIBUTION SYSTEM SITE 3 STANDING	DISTRIBUTION SYSTEM SITE 3 FREE FLOW
LANGELIERS INDEX (DIMNSLESS)			DET'N LIMIT = N/A	GUIDELINE = N/A				
JAN	.478	.309	.404	.310	.491	.411	.	.
MAR	.484	.228	.188	.185	.174	.158	.	.
MAY	.570	.393	.373	.394	.	.	.184	.227
JUL	.588	.369	.382	.369	.	.	.421	.428
SEP	.470	.324	.348	.350	.	.	.300	.267
NOV	.510	.287	.258	.233	.	.	.262	.227
MAGNESIUM (MG/L)			DET'N LIMIT = 0.10	GUIDELINE = 30 (F2)				
JAN	8.500	8.350	8.450	8.350	8.300	8.350	.	.
MAR	8.900	8.800	8.700	8.700	8.700	8.800	.	.
MAY	8.850	8.750	8.800	8.700	.	.	8.700	8.600
JUL	8.500	8.300	8.200	8.500	.	.	8.650	8.650
SEP	8.800	8.600	8.700	8.600	.	.	8.600	8.800
NOV	8.850	9.000	8.800	8.950	.	.	8.850	8.900
SODIUM (MG/L)			DET'N LIMIT = 0.2	GUIDELINE = 200 (A4)				
JAN	12.600	13.000	13.000	13.000	13.200	13.200	.	.
MAR	14.800	14.000	12.400	12.600	13.400	13.800	.	.
MAY	13.400	13.800	14.100	13.700	.	.	13.700	13.900
JUL	13.800	14.400	12.800	13.800	.	.	13.000	13.300
SEP	11.800	11.800	12.200	12.200	.	.	11.600	11.400
NOV	12.900	13.600	12.400	13.700	.	.	12.400	12.500
AMMONIUM TOTAL (MG/L)			DET'N LIMIT = 0.002	GUIDELINE = 0.05 (F2)				
JAN	BDL	.088	.168	.220	.148	.160	.	.
MAR	.048	.176	.158	.198	.164	.150	.	.
MAY	BDL	.144	.198	.162	.	.	.196	.164
JUL	.034	.216	.146	.188	.	.	.190	.174
SEP	BDL	.120	.128	.136	.	.	.082	BDL
NOV	BDL	.174	.160	.174	.	.	.174	.138
NITRITE (MG/L)			DET'N LIMIT = 0.001	GUIDELINE = 1 (A1)				
JAN	.008	.001 <T	.003 <T	.001 <T	.011	.002 <T	.	.
MAR	.018	.002 <T	.003 <T	.002 <T	.007	.002 <T	.	.
MAY	.007	.002 <T	.011	.002 <T	.	.	.004 <T	.001 <T
JUL	.012	.002 <T	.014	.004 <T	.	.	.006	.005
SEP	.008	.001 <T	.046	.002 <T	.	.	.068	.163
NOV	.008	.002 <T	.005	.003 <T	.	.	.026	.010

TABLE 5
ORINKING WATER SURVEILLANCE PROGRAM HAMILTON WSS 1990

SITE TYPE	WATER TREATMENT PLANT RAW	WATER TREATMENT PLANT TREATED	DISTRIBUTION SYSTEM SITE 1 STANDING	DISTRIBUTION SYSTEM SITE 1 FREE FLOW	DISTRIBUTION SYSTEM SITE 2 STANDING	DISTRIBUTION SYSTEM SITE 2 FREE FLOW	DISTRIBUTION SYSTEM SITE 3 STANDING	DISTRIBUTION SYSTEM SITE 3 FREE FLOW
TOTAL NITRATES (MG/L)			DET'N LIMIT = 0.005	GUIDELINE = 10 (A1)				
JAN	.455	.455	.480	.460	.520	.455	.	.
MAR	.485	.435	.375	.395	.405	.420	.	.
MAY	.365	.375	.395	.375	.	.	.405	.415
JUL	.355	.400	.355	.395	.	.	.370	.355
SEP	.460	.415	.445	.425	.	.	.375	.420
NOV	.430	.475	.415	.500	.	.	.415	.410
NITROGEN TOT KJELD (MG/L)			DET'N LIMIT = 0.02	GUIDELINE = N/A				
JAN	.270	.270	.310	.380	.350	.330	.	.
MAR	.340	.420	.330	.360	.340	.320	.	.
MAY	.310	.350	.470	.390	.	.	.420	.350
JUL	.360	.440	.410	.420	.	.	.450	.430
SEP	.200	.250	.330	.300	.	.	.270	.260
NOV	.280	.400	.380	.370	.	.	.400	.330
PH (DMNSLESS)			DET'N LIMIT = N/A	GUIDELINE = 6.5-8.5(A4)				
JAN	8.300	8.170	8.260	8.160	8.350	8.260	.	.
MAR	8.290	8.050	8.030	8.020	8.010	8.000	.	.
MAY	8.380	8.220	8.200	8.220	.	.	8.050	8.100
JUL	8.410	8.210	8.220	8.200	.	.	8.240	8.240
SEP	8.270	8.160	8.160	8.180	.	.	8.150	8.130
NOV	8.300	8.100	8.090	8.050	.	.	8.080	8.050
PHOSPHORUS FIL REACT (MG/L)			DET'N LIMIT = 0.0005	GUIDELINE = N/A				
JAN	.011	.002	.	.	.	.	.	.
MAR	.000 <T	.002 <T	.	.	.	.	.	.
MAY	.000 <T	.001 <T	.	.	.	.	.	.
JUL	.000 <T	.001 <T	.	.	.	.	.	.
SEP	BDL	.001 <T	.	.	.	.	.	.
NOV	.000 <T	.001 <T	.	.	.	.	.	.
PHOSPHORUS TOTAL (MG/L)			DET'N LIMIT = 0.002	GUIDELINE = .40 (F2)				
JAN	.030	.006 <T	.	.	.	.	.	.
MAR	.019	.010	.	.	.	.	.	.
MAY	.017	.025	.	.	.	.	.	.
JUL	.012	.010	.	.	.	.	.	.
SEP	.008 <T	.005 <T	.	.	.	.	.	.
NOV	.017	.005 <T	.	.	.	.	.	.

TABLE 5
DRINKING WATER SURVEILLANCE PROGRAM HAMILTON WSS 1990

SITE TYPE	WATER TREATMENT PLANT		DISTRIBUTION SYSTEM					
	RAW	TREATED	SITE 1		SITE 2		SITE 3	
			STANDING	FREE FLOW	STANDING	FREE FLOW	STANDING	FREE FLOW
SULPHATE (MG/L)			DET'N LIMIT = .200		GUIDELINE = 500 (A3)			
JAN	27.840	30.440	29.680	30.500	29.650	29.660	.	.
MAR	30.580	29.870	28.080	29.170	28.090	29.180	.	.
MAY	27.880	28.020	28.010	27.970	.	.	28.340	28.510
JUL	27.420	27.500	26.710	27.860	.	.	26.810	26.980
SEP	26.950	27.180	27.490	27.280	.	.	26.760	26.680
NOV	28.140	28.780	27.810	28.520	.	.	27.860	27.300
TURBIDITY (FTU)			DET'N LIMIT = 0.05		GUIDELINE = 1 (A1)			
JAN	25.000	1.100	.540	.640	.350	.750	.	.
MAR	1.280	.490	.240	.460	.420	.830	.	.
MAY	1.600	.600	.430	.650	.	.	.690	.940
JUL	1.050	.420	.280	.460	.	.	.320	.300
SEP	1.100	.410	.230	.340	.	.	.330	.330
NOV	6.000	.590	.250	.330	.	.	.340	.380

TABLE 5
DRINKING WATER SURVEILLANCE PROGRAM HAMILTON WSS 1990

SITE TYPE	RAW	TREATED	WATER TREATMENT PLANT SITE 1 STANDING	WATER TREATMENT PLANT SITE 1 FREE FLOW	DISTRIBUTION SYSTEM SITE 2 STANDING	DISTRIBUTION SYSTEM SITE 2 FREE FLOW	DISTRIBUTION SYSTEM SITE 3 STANDING	DISTRIBUTION SYSTEM SITE 3 FREE FLOW
METALS								
SILVER (UG/L)			DET'N LIMIT = 0.05	GUIDELINE = 50 (A1)				
JAN	BDL	BDL	BDL	BDL	BDL	BDL	.	.
MAR	BDL	BDL	BDL	BDL	BDL	BDL	.	.
MAY	BDL	BDL	BDL	BDL	.	.	BDL	BDL
JUL	BDL	BDL	BDL	BDL	.	.	BDL	BDL
SEP	BDL	BDL	BDL	BDL	.	.	BDL	BDL
NOV	BDL	.060 <T	BDL	BDL	.	.	BDL	BDL
ALUMINUM (UG/L)			DET'N LIMIT = 0.10	GUIDELINE = 100 (A4)				
JAN	150.000	74.000	56.000	53.000	81.000	53.000	.	.
MAR	9.900	56.000	56.000	54.000	63.000	57.000	.	.
MAY	15.000	130.000	160.000	140.000	.	.	94.000	110.000
JUL	6.600	160.000	190.000	170.000	.	.	140.000	140.000
SEP	5.000	51.000	68.000	57.000	.	.	110.000	110.000
NOV	41.000	75.000	68.000	63.000	.	.	72.000	71.000
ARSENIC (UG/L)			DET'N LIMIT = 0.10	GUIDELINE = 25 (A1)				
JAN	.840 <T	.840 <T	.670 <T	.470 <T	.740 <T	.630 <T	.	.
MAR	.660 <T	1.000 <T	.860 <T	.970 <T	.740 <T	.910 <T	.	.
MAY	.740 <T	.920 <T	1.100	1.100	.	.	1.100	1.300
JUL	.900 <T	1.200	1.000 <T	1.400	.	.	1.300	1.200
SEP	.920 <T	1.100	.940 <T	.960 <T	.	.	1.200	1.200
NOV	.790 <T	.810 <T	.670 <T	1.000 <T	.	.	.880 <T	.950 <T
BARIUM (UG/L)			DET'N LIMIT = 0.05	GUIDELINE = 1000 (A2)				
JAN	26.000	23.000	24.000	25.000	25.000	24.000	.	.
MAR	23.000	23.000	23.000	22.000	22.000	22.000	.	.
MAY	24.000	24.000	24.000	23.000	.	.	24.000	23.000
JUL	22.000	22.000	23.000	25.000	.	.	24.000	24.000
SEP	24.000	24.000	25.000	24.000	.	.	24.000	24.000
NOV	23.000	22.000	23.000	24.000	.	.	24.000	24.000
BORON (UG/L)			DET'N LIMIT = 2.00	GUIDELINE = 5000 (A1)				
JAN	26.000	25.000	25.000	25.000	26.000	26.000	.	.
MAR	31.000	31.000	35.000	35.000	29.000	29.000	.	.
MAY	30.000	29.000	28.000	28.000	.	.	78.000	76.000
JUL	34.000	29.000	33.000	32.000	.	.	34.000	34.000
SEP	45.000	46.000	45.000	48.000	.	.	48.000	46.000
NOV	31.000	34.000	27.000	33.000	.	.	31.000	32.000

TABLE 5
DRINKING WATER SURVEILLANCE PROGRAM HAMILTON WSS 1990

SITE		WATER TREATMENT PLANT				DISTRIBUTION SYSTEM			
	RAW	TREATED	SITE 1		SITE 2		SITE 3	
TYPE			STANDING	FREE FLOW	STANDING	FREE FLOW	STANDING	FREE FLOW
BERYLLIUM (UG/L)			DET'N LIMIT = 0.05		GUIDELINE = 6800 (D4)			
JAN	BDL	BDL	BDL	BDL	BDL	BDL	.	.
MAR	BDL	BDL	BDL	BDL	BDL	BDL	.	.
MAY	BDL	BDL	BDL	BDL	.	.	.060 <T	BDL
JUL	BDL	BDL	BDL	BDL	.	.	BDL	BDL
SEP	BDL	BDL	BDL	BDL	.	.	BDL	BDL
NOV	BDL	BDL	BDL	BDL	.	.	BDL	BDL
CADMIUM (UG/L)			DET'N LIMIT = 0.05		GUIDELINE = 5 (A1)			
JAN	.110 <T	BDL	BDL	BDL	.080 <T	.060 <T	.	.
MAR	BDL	.070 <T	BDL	BDL	BDL	BDL	.	.
MAY	.070 <T	BDL	BDL	BDL	.	.	BDL	BDL
JUL	BDL	BDL	BDL	BDL	.	.	BDL	BDL
SEP	BDL	BDL	BDL	BDL	.	.	BDL	BDL
NOV	BDL	BDL	BDL	.060 <T	.	.	BDL	BDL
COBALT (UG/L)			DET'N LIMIT = 0.02		GUIDELINE = N/A			
JAN	.220 <T	.120 <T	.140 <T	.110 <T	.110 <T	.100 <T	.	.
MAR	.110 <T	.050 <T	BDL	BDL	BDL	BDL	.	.
MAY	BDL	BDL	BDL	BDL	.	.	.210 <T	.180 <T
JUL	.200 <T	.170 <T	.190 <T	.240 <T	.	.	.230 <T	.210 <T
SEP	.060 <T	.070 <T	.060 <T	.090 <T	.	.	.080 <T	.040 <T
NOV	.200 <T	.080 <T	.080 <T	.110 <T	.	.	.100 <T	.070 <T
CHROMIUM (UG/L)			DET'N LIMIT = 0.50		GUIDELINE = 50 (A1)			
JAN	1.400 <T	1.100 <T	.650 <T	1.300 <T	.800 <T	.730 <T	.	.
MAR	.690 <T	.910 <T	2.300 <T	2.300 <T	.580 <T	.510 <T	.	.
MAY	.700 <T	.690 <T	.600 <T	.530 <T	.	.	3.600 <T	3.400 <T
JUL	1.500 <T	.740 <T	1.600 <T	1.100 <T	.	.	1.600 <T	1.500 <T
SEP	4.200 <T	4.800 <T	3.900 <T	4.900 <T	.	.	4.800 <T	4.600 <T
NOV	2.200 <T	2.200 <T	.730 <T	2.300 <T	.	.	2.300 <T	2.400 <T
COPPER (UG/L)			DET'N LIMIT = 0.50		GUIDELINE = 1000 (A3)			
JAN	2.000 <T	1.300 <T	17.000	2.900 <T	97.000	24.000	.	.
MAR	1.800 <T	1.100 <T	22.000	2.700 <T	140.000	19.000	.	.
MAY	1.600 <T	.970 <T	8.000	2.900 <T	.	.	640.000	20.000
JUL	2.100 <T	1.000 <T	12.000	2.200 <T	.	.	260.000	15.000
SEP	1.800 <T	1.100 <T	10.000	3.700 <T	.	.	180.000	14.000
NOV	1.500 <T	1.200 <T	17.000	3.000 <T	.	.	440.000	24.000

TABLE 5
DRINKING WATER SURVEILLANCE PROGRAM HAMILTON WSS 1990

SITE TYPE	WATER TREATMENT PLANT RAW	WATER TREATMENT PLANT TREATED	DISTRIBUTION SYSTEM SITE 1 STANDING	DISTRIBUTION SYSTEM SITE 1 FREE FLOW	DISTRIBUTION SYSTEM SITE 2 STANDING	DISTRIBUTION SYSTEM SITE 2 FREE FLOW	DISTRIBUTION SYSTEM SITE 3 STANDING	DISTRIBUTION SYSTEM SITE 3 FREE FLOW
IRON (UG/L)			DET'N LIMIT = 6.00	GUIDELINE = 300 (A3)				
JAN	280.000	28.000 <T	23.000 <T	45.000 <T	BDL	7.000 <T	.	.
MAR	17.000 <T	7.400 <T	21.000 <T	27.000 <T	BDL	BDL	.	.
MAY	18.000 <T	BDL	17.000 <T	24.000 <T	.	.	BDL	BDL
JUL	12.000 <T	BDL	9.500 <T	13.000 <T	.	.	BDL	BDL
SEP	6.300 <T	BDL	10.000 <T	18.000 <T	.	.	BDL	BDL
NOV	90.000	BDL	21.000 <T	40.000 <T	.	.	BDL	BDL
MANGANESE (UG/L)			DET'N LIMIT = 0.05	GUIDELINE = 50 (A3)				
JAN	18.000	1.200	1.600	2.000	1.100	.610	.	.
MAR	3.400	.550	1.400	1.300	.610	.430 <T	.	.
MAY	4.500	1.200	1.500	1.800	.	.	.950	.950
JUL	5.200	1.800	2.800	2.700	.	.	2.700	2.700
SEP	3.100	.420 <T	2.700	2.300	.	.	.960	.980
NOV	11.000	.790	.890	2.100	.	.	.450 <T	.460 <T
MOLYBDENUM (UG/L)			DET'N LIMIT = 0.05	GUIDELINE = N/A				
JAN	.910	1.300	1.300	1.300	1.300	1.400	.	.
MAR	1.300	1.200	1.100	1.100	1.300	1.200	.	.
MAY	1.100	1.200	1.200	1.100	.	.	1.200	1.300
JUL	1.200	1.300	1.200	1.400	.	.	1.300	1.300
SEP	1.200	1.300	1.300	1.200	.	.	1.300	1.300
NOV	1.200	1.300	1.200	1.500	.	.	1.300	1.300
NICKEL (UG/L)			DET'N LIMIT = 0.20	GUIDELINE = 350 (D3)				
JAN	2.100	1.800 <T	2.100	1.600 <T	1.800 <T	2.400	.	.
MAR	.610 <T	.550 <T	.550 <T	.350 <T	BDL	.480 <T	.	.
MAY	.940 <T	1.000 <T	.710 <T	.730 <T	.	.	1.300 <T	1.300 <T
JUL	1.000 <T	.530 <T	.520 <T	.670 <T	.	.	.340 <T	.230 <T
SEP	1.200 <T	1.200 <T	.930 <T	.950 <T	.	.	1.300 <T	.770 <T
NOV	1.600 <T	1.600 <T	1.400 <T	1.700 <T	.	.	1.700 <T	1.500 <T
LEAD (UG/L)			DET'N LIMIT = 0.05	GUIDELINE = 10. (A1)				
JAN	.670	.090 <T	1.300	4.700	3.100	.670	.	.
MAR	.160 <T	BDL	1.200	1.000	3.700	.410 <T	.	.
MAY	.200 <T	BDL	1.600	1.400	.	.	1.800	1.100
JUL	.180 <T	BDL	2.300	1.800	.	.	2.300	1.100
SEP	.130 <T	.070 <T	2.800	3.900	.	.	2.100	1.300
NOV	.430 <T	.070 <T	1.900	1.700	.	.	1.700	.650

TABLE 5
DRINKING WATER SURVEILLANCE PROGRAM HAMILTON WSS 1990

SITE TYPE	WATER TREATMENT PLANT		DISTRIBUTION SYSTEM					
	RAW	TREATED	SITE 1		SITE 2		SITE 3	
			STANDING	FREE FLOW	STANDING	FREE FLOW	STANDING	FREE FLOW
ANTIMONY (UG/L)			DET'N LIMIT = 0.05		GUIDELINE = 146 (D4)			
JAN	.400 <T	.450 <T	.560	.490 <T	.580	.580	.	.
MAR	.640	.390 <T	.530	.520	.590	.610	.	.
MAY	.630	.500 <T	.640	.780	.	.	.640	.640
JUL	.550	.390 <T	.750	.640	.	.	.710	.630
SEP	.540	.600	.570	.710	.	.	.550	.550
NOV	.540	.490 <T	.560	.590	.	.	.570	.560
SELENIUM (UG/L)			DET'N LIMIT = 1.00		GUIDELINE = 10 (A1)			
JAN	BDL	BDL	BDL	BDL	BDL	BDL	.	.
MAR	BDL	1.500 <T	1.600 <T	1.200 <T	2.000 <T	1.200 <T	.	.
MAY	BDL	BDL	BDL	BDL	.	.	1.200 <T	3.000 <T
JUL	BDL	BDL	1.600 <T	1.400 <T	.	.	BDL	BDL
SEP	BDL	1.100 <T	1.800 <T	2.000 <T	.	.	2.000 <T	1.700 <T
NOV	BDL	BDL	BDL	1.200 <T	.	.	1.400 <T	2.000 <T
STRONTIUM (UG/L)			DET'N LIMIT = 0.10		GUIDELINE = N/A			
JAN	190.000	190.000	200.000	190.000	190.000	190.000	.	.
MAR	190.000	190.000	170.000	180.000	180.000	180.000	.	.
MAY	190.000	200.000	190.000	200.000	.	.	180.000	180.000
JUL	190.000	200.000	190.000	190.000	.	.	190.000	190.000
SEP	190.000	200.000	200.000	200.000	.	.	190.000	190.000
NOV	190.000	200.000	190.000	210.000	.	.	200.000	200.000
TITANIUM (UG/L)			DET'N LIMIT = 0.50		GUIDELINE = N/A			
JAN	6.100	4.300 <T	3.500 <T	3.700 <T	3.200 <T	3.600 <T	.	.
MAR	2.500 <T	3.100 <T	3.700 <T	3.400 <T	4.700 <T	4.200 <T	.	.
MAY	4.400 <T	5.000 <T	5.200	4.900 <T	.	.	7.800	7.800
JUL	2.700 <T	3.200 <T	2.900 <T	3.200 <T	.	.	3.200 <T	3.200 <T
SEP	4.000 <T	4.200 <T	4.200 <T	4.100 <T	.	.	3.800 <T	3.800 <T
NOV	3.000 <T	2.100 <T	1.900 <T	2.400 <T	.	.	2.400 <T	2.300 <T
URANIUM (UG/L)			DET'N LIMIT = 0.05		GUIDELINE = 100 (A1)			
JAN	.380 <T	.360 <T	.330 <T	.340 <T	.350 <T	.330 <T	.	.
MAR	.330 <T	.350 <T	.350 <T	.320 <T	.290 <T	.290 <T	.	.
MAY	.290 <T	.340 <T	.380 <T	.310 <T	.	.	.300 <T	.370 <T
JUL	.250 <T	.270 <T	.300 <T	.340 <T	.	.	.330 <T	.360 <T
SEP	.330 <T	.370 <T	.380 <T	.370 <T	.	.	.300 <T	.370 <T
NOV	.350 <T	.350 <T	.340 <T	.340 <T	.	.	.310 <T	.340 <T

TABLE 5
DRINKING WATER SURVEILLANCE PROGRAM HAMILTON WSS 1990

SITE TYPE	WATER TREATMENT PLANT RAW	WATER TREATMENT PLANT TREATED	DISTRIBUTION SYSTEM SITE 1 STANDING	DISTRIBUTION SYSTEM SITE 1 FREE FLOW	DISTRIBUTION SYSTEM SITE 2 STANDING	DISTRIBUTION SYSTEM SITE 2 FREE FLOW	DISTRIBUTION SYSTEM SITE 3 STANDING	DISTRIBUTION SYSTEM SITE 3 FREE FLOW
VANADIUM (UG/L)			DET'N LIMIT = 0.05	GUIDELINE = N/A				
JAN	.640	.670	.480 <T	.520	.620	.490 <T	.	.
MAR	.200 <T	.180 <T	.180 <T	.150 <T	.170 <T	.170 <T	.	.
MAY	.230 <T	.210 <T	.250 <T	.190 <T	.	.	.220 <T	.250 <T
JUL	.270 <T	.240 <T	.200 <T	.270 <T	.	.	.260 <T	.270 <T
SEP	.260 <T	.280 <T	.250 <T	.230 <T	.	.	.300 <T	.300 <T
NOV	.300 <T	.200 <T	.140 <T	.160 <T	.	.	.180 <T	.150 <T
ZINC (UG/L)			DET'N LIMIT = 0.2	GUIDELINE = 5000 (A3)				
JAN	33.000	2.700	3.600	8.700	6.900	3.300	.	.
MAR	3.100	1.600 <T	2.700	1.600 <T	12.000	2.200	.	.
MAY	2.500	1.500 <T	4.100	2.100	.	.	7.500	2.800
JUL	2.700	1.700 <T	2.600	1.800 <T	.	.	6.700	2.900
SEP	2.900	2.000 <T	4.700	3.200	.	.	9.000	3.600
NOV	4.200	3.500	4.200	3.200	.	.	13.000	4.600

TABLE 5
DRINKING WATER SURVEILLANCE PROGRAM HAMILTON WSS 1990

SITE	WATER TREATMENT PLANT		DISTRIBUTION SYSTEM					
			SITE 1		SITE 2		SITE 3	
TYPE	RAW	TREATED	STANDING	FREE FLOW	STANDING	FREE FLOW	STANDING	FREE FLOW
CHLOROAROMATICS								
HCB (NG/L)			DET'N LIMIT = 1.000		GUIDELINE = 10 (C1)			
JAN	BDL	BDL	.	BDL	.	BDL	.	.
MAR	BDL	BDL	.	BDL	.	BDL	.	.
MAY	BDL	BDL	.	BDL	.	.	.	BDL
JUL	BDL	BDL	.	13.000	.	.	.	BDL
SEP	BDL	BDL	.	BDL	.	.	.	BDL
NOV	BDL	BDL	.	BDL	.	.	.	BDL
HEXACHLOROETHANE (NG/L)			DET'N LIMIT = 1.000		GUIDELINE = 1900 (D4)			
JAN	BDL	BDL	.	BDL	.	BDL	.	.
MAR	BDL	BDL	.	BDL	.	BDL	.	.
MAY	BDL	BDL	.	BDL	.	.	.	BDL
JUL	BDL	BDL	.	BDL	.	.	.	BDL
SEP	BDL	BDL	.	BDL	.	.	.	BDL
NOV	1.000 <T	3.000 <T	.	BDL	.	.	.	BDL

TABLE 5
DRINKING WATER SURVEILLANCE PROGRAM HAMILTON WSS 1990

SITE TYPE	WATER TREATMENT PLANT		DISTRIBUTION SYSTEM					
	RAW	TREATED	SITE 1		SITE 2		SITE 3	
			STANDING	FREE FLOW	STANDING	FREE FLOW	STANDING	FREE FLOW
PAH BENZO(K) FLUORANTHEN (NG/L)			DET'N LIMIT = 1.		GUIDELINE = N/A			
JAN	BDL	BDL	.	.	.	.	.	.
MAR	BDL	BDL	.	.	.	.	.	.
MAY	BDL	BDL	.	.	.	.	.	.
JUL	BDL	BDL	.	BDL	.	.	.	BDL
SEP	BDL	BDL	.	.	.	.	.	.
NOV	1.000 <T	BDL	.	.	.	.	.	.

TABLE 5
DRINKING WATER SURVEILLANCE PROGRAM HAMILTON WSS 1990

SITE TYPE	WATER TREATMENT PLANT		DISTRIBUTION SYSTEM					
	RAW	TREATED	SITE 1		SITE 2		SITE 3	
			STANDING	FREE FLOW	STANDING	FREE FLOW	STANDING	FREE FLOW
PESTICIDES & PCB								
ALPHA BHC (NG/L)			DET'N LIMIT = 1.000	GUIDELINE = 700 (G)				
JAN	2.000 <T	3.000 <T	.	BDL	.	2.000 <T	.	.
MAR	1.000 <T	1.000 <T	.	1.000 <T	.	1.000 <T	.	.
MAY	BDL	2.000 <T	.	1.000 <T	.	.	.	2.000 <T
JUL	1.000 <T	1.000 <T	.	1.000 <T	.	.	.	1.000 <T
SEP	1.000 <T	1.000 <T	.	1.000 <T	.	.	.	1.000 <T
NOV	1.000 <T	2.000 <T	.	1.000 <T	.	.	.	2.000 <T
LINDANE (NG/L)			DET'N LIMIT = 1.000	GUIDELINE = 4000 (A1)				
JAN	BDL	1.000 <T	.	BDL	.	1.000 <T	.	.
MAR	BDL	BDL	.	BDL	.	BDL	.	.
MAY	BDL	BDL	.	BDL	.	.	.	BDL
JUL	BDL	BDL	.	1.000 <T	.	.	.	BDL
SEP	BDL	BDL	.	BDL	.	.	.	BDL
NOV	BDL	BDL	.	BDL	.	.	.	BDL
ATRAZINE (NG/L)			DET'N LIMIT = 50	GUIDELINE = 60000 (A2)				
JAN	BDL	BDL	.	.	.	.	.	.
MAR	BDL	BDL	.	.	.	.	.	.
MAY	100.000 <T	100.000 <T	.	.	.	.	.	.
JUL	BDL	110.000 <T	.	.	.	.	.	.
SEP	BDL	!!S	.	.	.	.	.	.
NOV	BDL	BDL	.	.	.	.	.	.

TABLE 5
DRINKING WATER SURVEILLANCE PROGRAM HAMILTON WSS 1990

SITE		WATER TREATMENT PLANT		DISTRIBUTION SYSTEM					
	RAW	TREATED	SITE 1		SITE 2		SITE 3		
TYPE			STANDING	FREE FLOW	STANDING	FREE FLOW	STANDING	FREE FLOW	
PHENOLICS (UG/L)	PHENOLICS		DET'N LIMIT = .20		GUIDELINE = 2 (A4)				
JAN	BDL	.400 <T	.	.	.	.	.	.	
MAR	.600 <T	BDL	.	.	.	.	.	.	
MAY	BDL	.600 <T	.	.	.	.	.	.	
JUL	BDL	.800 <T	.	.	.	.	.	.	
SEP	BDL	1.200	.	.	.	.	.	.	
NOV	BDL	BDL	.	.	.	.	.	.	

TABLE 5
DRINKING WATER SURVEILLANCE PROGRAM HAMILTON WSS 1990

SITE TYPE	WATER TREATMENT PLANT RAW	WATER TREATMENT PLANT TREATED	DISTRIBUTION SYSTEM SITE 1 STANDING	DISTRIBUTION SYSTEM SITE 1 FREE FLOW	DISTRIBUTION SYSTEM SITE 2 STANDING	DISTRIBUTION SYSTEM SITE 2 FREE FLOW	DISTRIBUTION SYSTEM SITE 3 STANDING	DISTRIBUTION SYSTEM SITE 3 FREE FLOW
VOLATILES								
BENZENE (UG/L)		DET'N LIMIT = 0.05		GUIDELINE = 5 (A1)				
JAN	BDL	BDL	.	IU	.	BDL	.	.
MAR	BDL	.100 <T	.	.050 <T	.	IU	.	.
MAY	BDL	BDL	.	.050 <T	.	.	.	BDL
JUL	BDL	BDL	.	.050 <T	.	.	.	BDL
SEP	BDL	BDL	.	BDL	.	.	.	BDL
NOV	BDL	BDL	.	BDL	.	.	.	BDL
TOLUENE (UG/L)		DET'N LIMIT = 0.05		GUIDELINE = 24 (A3)				
JAN	BDL	BDL	.	IU	.	BDL	.	.
MAR	BDL	BDL	.	BDL	.	IU	.	.
MAY	BDL	BDL	.	.100 <T	.	.	.	BDL
JUL	BDL	BDL	.	.150 <T	.	.	.	BDL
SEP	BDL	.050 <T	.	.150 <T	.	.	.	.150 <T
NOV	BDL	BDL	.	.050 <T	.	.	.	BDL
ETHYLBENZENE (UG/L)		DET'N LIMIT = 0.05		GUIDELINE = 2.4 (A3)				
JAN	BDL	BDL	.	IU	.	BDL	.	.
MAR	BDL	.250 <T	.	.150 <T	.	IU	.	.
MAY	BDL	BDL	.	.100 <T	.	.	.	BDL
JUL	BDL	.150 <T	.	BDL	.	.	.	BDL
SEP	BDL	BDL	.	BDL	.	.	.	BDL
NOV	BDL	.050 <T	.	.100 <T	.	.	.	.050 <T
STYRENE (UG/L)		DET'N LIMIT = 0.05		GUIDELINE = 100 (D1)				
JAN	BDL	BDL	.	IU	.	.050 <T	.	.
MAR	BDL	.200 <T	.	.100 <T	.	IU	.	.
MAY	.050 <T	BDL	.	.100 <T	.	.	.	BDL
JUL	BDL	.250 <T	.	BDL	.	.	.	BDL
SEP	BDL	BDL	.	BDL	.	.	.	BDL
NOV	BDL	.050 <T	.	.050 <T	.	.	.	.050 <T
CHLOROFORM (UG/L)		DET'N LIMIT = 0.10		GUIDELINE = 350 (A1+)				
JAN	BDL	9.300	.	IU	.	7.100	.	.
MAR	BDL	7.300	.	7.500	.	IU	.	.
MAY	BDL	14.400	.	13.900	.	.	.	12.400
JUL	BDL	15.000	.	13.300	.	.	.	15.200
SEP	BDL	7.100	.	6.700	.	.	.	12.000
NOV	BDL	8.700	.	9.100	.	.	.	7.800

TABLE 5
DRINKING WATER SURVEILLANCE PROGRAM HAMILTON WSS 1990

SITE TYPE		WATER TREATMENT PLANT RAW	WATER TREATMENT PLANT TREATED	DISTRIBUTION SYSTEM SITE 1 STANDING	DISTRIBUTION SYSTEM SITE 1 FREE FLOW	DISTRIBUTION SYSTEM SITE 2 STANDING	DISTRIBUTION SYSTEM SITE 2 FREE FLOW	DISTRIBUTION SYSTEM SITE 3 STANDING	DISTRIBUTION SYSTEM SITE 3 FREE FLOW
DICHLOROBROMOMETHANE (UG/L)			DET'N LIMIT = 0.05		GUIDELINE = 350 (A1+)				
JAN	BDL	9.050	.	!U	.	7.200	.	.	
MAR	BDL	6.750	.	6.700	.	!U	.	.	
MAY	BDL	8.650	.	8.250	.	.	.	8.250	
JUL	BDL	9.800	.	9.300	.	.	.	9.300	
SEP	BDL	6.900	.	6.350	.	.	.	8.000	
NOV	BDL	7.600	.	7.850	.	.	.	7.100	
CHLORODIBROMOMETHANE (UG/L)			DET'N LIMIT = 0.10		GUIDELINE = 350 (A1+)				
JAN	BDL	4.700	.	!U	.	4.300	.	.	
MAR	BDL	4.100	.	4.000	.	!U	.	.	
MAY	BDL	3.600	.	3.500	.	.	.	4.400	
JUL	BDL	5.500	.	5.100	.	.	.	4.400	
SEP	BDL	3.600	.	3.600	.	.	.	4.200	
NOV	BDL	4.800	.	4.600	.	.	.	4.100	
BROMOFORM (UG/L)			DET'N LIMIT = 0.20		GUIDELINE = 350 (A1+)				
JAN	BDL	.600 <T	.	!U	.	.600 <T	.	.	
MAR	BDL	.600 <T	.	.600 <T	.	!U	.	.	
MAY	BDL	.400 <T	.	.400 <T	.	.	.	.400 <T	
JUL	BDL	.800 <T	.	.600 <T	.	.	.	.600 <T	
SEP	BDL	.400 <T	.	.400 <T	.	.	.	.400 <T	
NOV	BDL	.600 <T	.	.600 <T	.	.	.	.600 <T	
TOTL TRIHALOMETHANES (UG/L)			DET'N LIMIT = 0.50		GUIDELINE = 350 (A1)				
JAN	BDL	23.700	.	!U	.	19.200	.	.	
MAR	BDL	18.750	.	18.800	.	!U	.	.	
MAY	BDL	26.950	.	25.950	.	.	.	25.450	
JUL	BDL	31.100	.	28.300	.	.	.	29.500	
SEP	BDL	18.050	.	17.050	.	.	.	24.650	
NOV	BDL	21.700	.	22.150	.	.	.	19.650	

TRACE LEVELS OF TOLUENE ARE LABORATORY ARTIFACTS DERIVED FROM THE ANALYTICAL METHODOLOGY.

TRACE LEVELS OF STYRENE ARE CONSIDERED TO BE LABORATORY ARTIFACTS RESULTING FROM THE LABORATORY SHIPPING CONTAINERS.

TABLE 6
DRINKING WATER SURVEILLANCE PROGRAM 1990

SCAN/PARAMETER	UNIT	DETECTION LIMIT	GUIDELINE	
BACTERIOLOGICAL				
FECAL COLIFORM MEMBRANE FILTRATION	CT/100ML	0	0	(A1)
STANDARD PLATE COUNT MEMBRANE FILT.	CT/ML	0	500/ML	(A3)
TOTAL COLIFORM BACKGROUND MF	CT/100ML	0	N/A	
TOTAL COLIFORM MEMBRANE FILTRATION	CT/100ML	0	5/100ML	(A1)
CHEMISTRY (FLD)				
FIELD COMBINED CHLORINE RESIDUAL	MG/L	0	N/A	
FIELD TOTAL CHLORINE RESIDUAL	MG/L	0	N/A	
FIELD FREE CHLORINE RESIDUAL	MG/L	0	N/A	
FIELD PH	DMNSLESS	N/A	6.5-8.5	(A3)
FIELD TEMPERATURE	DEG.C	N/A	15.0	(A3)
FIELD TURBIDITY	FTU	N/A	1.0	(A1)
CHEMISTRY (LAB)				
ALKALINITY	MG/L	0.2	30-500	(A3)
AMMONIUM TOTAL	MG/L	0.002	0.05	(F2)
CALCIUM	MG/L	0.2	100	(F2)
CHLORIDE	MG/L	0.2	250	(A3)
COLOUR	TCU	0.5	5.0	(A3)
CONDUCTIVITY	UMHO/CM	1.0	400	(F2)
CYANIDE	MG/L	0.001	0.2	(A1)
DISSOLVED ORGANIC CARBON	MG/L	0.1	5.0	(A3)
FLUORIDE	MG/L	0.01	2.4	(A1)
HARDNESS	MG/L	0.5	80-100	(A4)
LANGELIERS INDEX	DMNSLESS	N/A	N/A	
MAGNESIUM	MG/L	0.1	30.0	(F2)
NITRITE	MG/L	0.001	1.0	(A1)
NITROGEN TOTAL KJELDAHL	MG/L	0.02	N/A	
PH	DMNSLESS	N/A	6.5-8.5	(A4)
PHOSPHORUS FIL REACT	MG/L	0.0005	N/A	
PHOSPHORUS TOTAL	MG/L	0.002	0.4	(F2)
SODIUM	MG/L	0.2	200	(A4)
SULPHATE	MG/L	0.2	500	(A3)
TOTAL NITRATES	MG/L	0.005	10.0	(A1)
TURBIDITY	FTU	0.05	1.0	(A1)
CHLOROAROMATICS				
123 TRICHLOROBENZENE	NG/L	5.0	N/A	
1234 TETRACHLOROBENZENE	NG/L	1.0	N/A	
1235 TETRACHLOROBENZENE	NG/L	1.0	N/A	
124 TRICHLOROBENZENE	NG/L	5.0	10000	(I)
1245-TETRACHLOROBENZENE	NG/L	1.0	38000	(D4)
135 TRICHLOROBENZENE	NG/L	5.0	N/A	
236 TRICHLOROTOLUENE	NG/L	5.0	N/A	
245 TRICHLOROTOLUENE	NG/L	5.0	N/A	
26A TRICHLOROTOLUENE	NG/L	5.0	N/A	
HEXACHLOROBENZENE	NG/L	1.0	10	(C1)
HEXACHLOROBUTADIENE	NG/L	1.0	450	(D4)
HEXACHLOROCYCLOPENTADIENE	NG/L	5.0	206000	(D4)
HEXACHLOROETHANE	NG/L	1.0	1900	(D4)
OCTACHLOROSTYRENE	NG/L	1.0	N/A	
PENTACHLOROBENZENE	NG/L	1.0	74000	(D4)
CHLOROPHENOLS				
234 TRICHLOROPHENOL	NG/L	100.0	N/A	
2345 TETRACHLOROPHENOL	NG/L	20.0	N/A	
2356 TETRACHLOROPHENOL	NG/L	10.0	N/A	

TABLE 6
DRINKING WATER SURVEILLANCE PROGRAM 1990

SCAN/PARAMETER	UNIT	DETECTION LIMIT	GUIDELINE
245 TRICHLOROPHENOL	NG/L	100.0	2600000 (D4)
246 TRICHLOROPHENOL	NG/L	20.0	5000 (A1)
PENTACHLOROPHENOL	NG/L	10.0	60000 (A1)
METALS			
ALUMINUM	UG/L	0.10	100 (A4)
ANTIMONY	UG/L	0.05	146 (D4)
ARSENIC	UG/L	0.10	25 (A1)
BARIUM	UG/L	0.05	1000 (A2)
BERYLLIUM	UG/L	0.05	6800 (D4)
BORON	UG/L	2.00	5000 (A1)
CADMIUM	UG/L	0.05	5 (A1)
CHROMIUM	UG/L	0.50	50 (A1)
COBALT	UG/L	0.02	N/A
COPPER	UG/L	0.50	1000 (A3)
IRON	UG/L	6.00	300 (A3)
LEAD	UG/L	0.05	10 (A1)
MANGANESE	UG/L	0.05	50 (A3)
MERCURY	UG/L	0.02	1 (A1)
MOLYBDENUM	UG/L	0.05	N/A
NICKEL	UG/L	0.20	350 (D3)
SELENIUM	UG/L	1.00	10 (A1)
SILVER	UG/L	0.05	50 (A1)
STRONTIUM	UG/L	0.10	N/A
THALLIUM	UG/L	0.05	13 (D4)
TITANIUM	UG/L	0.50	N/A
URANIUM	UG/L	0.05	100 (A1)
VANADIUM	UG/L	0.05	N/A
ZINC	UG/L	0.20	5000 (A3)
PAH			
ANTHRACENE	NG/L	1.0	N/A
BENZO(A) ANTHRACENE	NG/L	20.0	N/A
BENZO(A) PYRENE	NG/L	5.0	10.0 (A1)
BENZO(B) CHRYSENE	NG/L	2.0	N/A
BENZO(B) FLUORANTHENE	NG/L	10.0	N/A
BENZO(E) PYRENE	NG/L	50.0	N/A
BENZO(G,H,I) PERYLENE	NG/L	20.0	N/A
BENZO(K) FLUORANTHENE	NG/L	1.0	N/A
CHRYSENE	NG/L	50.0	N/A
CORONENE	NG/L	10.0	N/A
DIBENZO(A,H) ANTHRACENE	NG/L	10.0	N/A
DIMETHYL BENZO(A) ANTHRACENE	NG/L	5.0	N/A
FLUORANTHENE	NG/L	20.0	42000.0 (D4)
INDENO(1,2,3-C,D) PYRENE	NG/L	20.0	N/A
PERYLENE	NG/L	10.0	N/A
PHENANTHRENE	NG/L	10.0	N/A
PYRENE	NG/L	20.0	N/A
PESTICIDES & PCB			
ALACHLOR (LASSO)	NG/L	500.0	5000 (A2)
ALDRIN	NG/L	1.0	700 (A1)
ALPHA HEXACHLOROCYCLOHEXANE (BHC)	NG/L	1.0	700 (G)
ALPHA CHLORDANE	NG/L	2.0	7000 (A1)
AMETRINE	NG/L	50.0	300000 (D3)
ATRATONE	NG/L	50.0	N/A
ATRAZINE	NG/L	50.0	60000 (A2)
DES ETHYL ATRAZINE	NG/L	200.0	60000 (A2)
BETA HEXACHLOROCYCLOHEXANE (BHC)	NG/L	1.0	300 (G)
CYANAZINE (BLADEX)	NG/L	100.0	10000 (A2)
O,P-DDD	NG/L	5.0	10 (I)
DIELDRIN	NG/L	2.0	700 (A1)
ENDOSULFAN 1 (THIODAN I)	NG/L	2.0	74000 (D4)
ENDOSULFAN 2 (THIODAN II)	NG/L	5.0	74000 (D4)

TABLE 6
DRINKING WATER SURVEILLANCE PROGRAM 1990

SCAN/PARAMETER	UNIT	DETECTION LIMIT	GUIDELINE
ENDOSULFAN SULPHATE (THIODAN SULPHATE)	NG/L	5.0	N/A
ENDRIN	NG/L	5.0	1600 (D3)
GAMMA CHLORDANE	NG/L	2.0	7000 (A1)
HEPTACHLOR	NG/L	1.0	3000 (A1)
HEPTACHLOR EPOXIDE	NG/L	1.0	3000 (A1)
LINDANE (GAMMA BHC)	NG/L	1.0	4000 (A1)
METHOXYCHLOR	NG/L	5.0	900000 (A1)
METOLACHLOR	NG/L	500.0	50000 (A2)
METRIBUZIN (SENCOR)	NG/L	100.0	80000 (A1)
MIREX	NG/L	5.0	N/A
P,P-DDD	NG/L	5.0	N/A
O,P-DDT	NG/L	5.0	30000 (A1)
OXYCHLORDANE	NG/L	2.0	N/A
PCB	NG/L	20.0	3000 (A2)
PPDDE	NG/L	1.0	30000 (A1)
PPDDT	NG/L	5.0	30000 (A1)
PROMETONE	NG/L	50.0	52500 (D3)
PROMETRYNE	NG/L	50.0	1000 (A2)
PROPAZINE	NG/L	50.0	700000 (D3)
SIMAZINE	NG/L	50.0	10000 (A2)
D-ETHYL SIMAZINE	NG/L	200.0	10000 (A2)
TOXAPHENE	NG/L	500.0	5000 (A1)
PHENOLICS			
PHENOLICS (UNFILTERED REACTIVE)	UG/L	0.2	2 (A4)
SPECIFIC PESTICIDES			
2,4 D PROPIONIC ACID	NG/L	100.	N/A
2,4,5-TRICHLOROPHENOXY ACETIC ACID	NG/L	50.	280000 (A1)
2,4-DICHLOROBUTYRIC ACID (2,4-D)	NG/L	100.	100000 (A1)
24-DICHLORORPHENOXYBUTYRIC ACID (24-DB)	NG/L	200.	18000 (B3)
BUTYLATE (SUTAN)	NG/L	2000.	245000 (D3)
CARBARYL (SEVIN)	NG/L	200.	90000 (A1)
CARBOFURAN	NG/L	2000.	90000 (A1)
CHLORPYRIFOS (DURSBAN)	NG/L	20.	N/A
CICP (CHLORPROPHAM)	NG/L	2000.	350000 (G)
DIALLATE	NG/L	2000.	N/A
DIAZINON	NG/L	20.	20000 (A1)
DICAMBA	NG/L	50.	120000 (A1)
DICHLOROVOS	NG/L	20.	N/A
EPTAM	NG/L	2000.	N/A
ETHION	NG/L	20.	35000 (G)
IPC	NG/L	2000.	N/A
MALATHION	NG/L	20.	190000 (A1)
METHYL PARATHION	NG/L	50.	7000 (B3)
METHYLTRITHION	NG/L	20.	N/A
MEVINPHOS	NG/L	20.	N/A
PARATHION	NG/L	20.	50000 (A1)
PHORATE (THIMET)	NG/L	20.	2000 (A2)
PROPOXUR (BAYGON)	NG/L	2000.	140000 (D3)
RELDAN	NG/L	20.	N/A
RONNEL	NG/L	20.	N/A
SILVEX (2,4,5-TP)	NG/L	20.	10000 (A1)
VOLATILES			
1,1 DICHLOROETHANE	UG/L	0.10	N/A
1,1 DICHLOROETHYLENE	UG/L	0.10	7 (D1)
1,2 DICHLOROBENZENE	UG/L	0.05	200 (A1)
1,2 DICHLOROETHANE	UG/L	0.05	5 (A1)

TABLE 6
DRINKING WATER SURVEILLANCE PROGRAM 1990

SCAN/PARAMETER	UNIT	DETECTION LIMIT	GUIDELINE
1,2 DICHLOROPROPANE	UG/L	0.05	5 (D1)
1,3 DICHLOROBENZENE	UG/L	0.10	3750 (D3)
1,4 DICHLOROBENZENE	UG/L	0.10	5 (A1)
111, TRICHLOROETHANE	UG/L	0.02	200 (D1)
112 TRICHLOROETHANE	UG/L	0.05	0.6 (D4)
1122 TETRACHLOROETHANE	UG/L	0.05	0.17(D4)
BENZENE	UG/L	0.05	5 (A1)
BROMOFORM	UG/L	0.20	350 (A1+)
CARBON TETRACHLORIDE	UG/L	0.20	5 (A1)
CHLOROBENZENE	UG/L	0.10	1510 (D3)
CHLORODIBROMOMETHANE	UG/L	0.10	350 (A1+)
CHLOROFORM	UG/L	0.10	350 (A1+)
DICHLOROBROMOMETHANE	UG/L	0.05	350 (A1+)
ETHLYENE DIBROMIDE	UG/L	0.05	50 (D1)
ETHYLBENZENE	UG/L	0.05	2.4 (A3)
M-XYLENE	UG/L	0.10	300 (A3*)
METHYLENE CHLORIDE	UG/L	0.50	50 (A1)
O-XYLENE	UG/L	0.05	300 (A3*)
P-XYLENE	UG/L	0.10	300 (A3*)
STYRENE	UG/L	0.05	100 (D1)
TETRACHLOROETHYLENE	UG/L	0.05	5 (D1)
TRANS 1,2 DICHLOROETHYLENE	UG/L	0.10	70 (D1)
TOLUENE	UG/L	0.05	24 (A3)
TOTAL TRIHALOMETHANES	UG/L	0.50	350 (A1)
TRICHLOROETHYLENE	UG/L	0.10	50 (A1)

Appendix A

DRINKING WATER SURVEILLANCE PROGRAM
PROGRAM DESCRIPTION

The Drinking Water Surveillance Program (DWSP) for Ontario monitors drinking water quality at municipal water supply systems. The DWSP Database Management System provides a computerized drinking water quality information system for the supplies monitored. The objectives of the program are to provide:

- immediate, reliable, current information on drinking water quality;
- a flagging mechanism for guideline exceedance;
- a definition of contaminant levels and trends;
- a comprehensive background for remedial action;
- a framework for assessment of new contaminants; and
- an indication of treatment efficiency of plant processes.

PROGRAM

The DWSP officially began in April 1986 and is designed to eventually include all municipal water supplies in Ontario. In 1990, 76 systems were being monitored. Water supply locations have been prioritized for surveillance based primarily on criteria such as population density, probability of contamination and geographical location.

An ongoing assessment of future monitoring requirements at each location will be made. Monitoring will continue at the initial locations at an appropriate level and further locations will be phased into the program as resources permit.

A major goal of the program is to collect valid water quality data in context with plant operational characteristics at the time of sampling. As soon as sufficient data have been accumulated and analyzed, both the frequency of sampling and the range of parameters may be adjusted accordingly.

Assessments are carried out at all locations prior to initial sampling, in order to acquire complete plant process and distribution system details and to designate (and retrofit if necessary) all sampling systems and locations. This ensures that the sampled water is a reflection of the water itself.

Samples are taken of raw (ambient water) and treated water at the treatment plant and of consumer's tap water in the distribution system. In order to determine possible effects of distribution on water quality, both standing and free flow water in old and new sections of the distribution system are sampled. Sampling is carried out by operational personnel who have been trained in applicable procedures.

Comprehensive standardized procedures and field test kits are supplied to sampling personnel. This ensures that samples are taken and handled according to standard protocols and that field testing will supply reliable data. All field and laboratory analyses are carried out using "approved documented procedures". Most laboratory analyses are carried out by the Ministry of Environment (MOE), Laboratory Services Branch. Radionuclides are analyzed by the Ministry of Labour.

DATA REPORTING MECHANISM

When the analytical results are transferred from the MOE laboratory into the DWSP system, printouts of the completed analyses are sent to the MOE District Officer, the appropriate operational staff and are also retained by the DWSP unit.

PROGRAM INPUTS AND OUTPUTS

There are four major inputs and four major outputs in the program.

Program Input - Plant and Distribution System Description

The system description includes plant specific non-analytical information acquired through a questionnaire and an initial plant visit. During the initial assessment of the plant and distribution system, questionnaire content is verified and missing information added. It is intended that all data be kept current with scheduled annual updates.

The Plant and Distribution System Description consists of the following seven components:

1. PROCESS COMPONENT INVENTORY
All physical and chemical processes to which the water is subjected, from the intake pipe to the consumers' tap (where possible), are documented. These include: process type, general description of physical structures, material types, sizes, and retention time for each process within the plant. The processes may be as simple as transmission or as complex as carbon adsorption.

2. TREATMENT CHEMICALS
Chemicals used in the treatment processes, their function, application point, supplier and brand-name are recorded. Chemical dosages applied on the day of sampling are recorded in DWSP.

3. PROCESS CONTROL MEASUREMENTS
Documentation of in-plant monitoring of process parameters (eg. turbidity, chlorine residuals, pH, aluminum residuals) including methods used, monitoring locations and frequency is contained in this section. Except for the recorded Field Data, in-plant monitoring results are not retained in DWSP but are retained by the water treatment plant personnel.

4. DESIGN FLOW AND RETENTION TIME
Hydraulic capacity, designed and actual, is noted here. Retention time (the time that a block of water is retained in the plant) is also noted. Maximum, minimum and average flow, as well as a record of the flow rate on the day of sampling, are recorded in DWSP.

5. DISTRIBUTION SYSTEM DESCRIPTION
This area includes the storage and transmission characteristics of the distribution system after the water leaves the plant.

6. SAMPLING SYSTEM
Each plant is assessed for its adequacy in terms of the sampling of bacteriological, organic and inorganic parameters. Prime considerations in the assessment and design of the sampling system are:

i/ the sample is an accurate representation of the actual water condition, eg. raw water has had no chemical treatment;

ii/ the water being sampled is not being modified by the sampling system;

iii/ the sample tap must be in a clean area of the plant, preferably a lab area; and

iv/ the sample lines must be organically inert (no plastic, ideally stainless steel).

It is imperative that the sampled water be a reflection not of the sampling system but of the water itself.

The sampling system documentation includes: origin of the water; date sampling was initiated; size, length and material type (intake,

discharge and tap); pump characteristics (model, type, capacity); and flow rate.

7. PERSONNEL
This section contains the names, addresses and phone numbers of current plant management and operational staff, distribution system management and operational staff, Medical Officer of Health and appropriate MOE personnel associated with the plant.

Program Input - Field Data

The second major input to DWSP is field data. Field data is collected at the plant and from the distribution system sites on the day of sampling. Field data consists of general operating conditions and the results of testing for field parameters. General operating conditions include chemicals used, dosages, flow and retention time on the day of sampling, as well as, monthly maximum, minimum and average flows. Field parameters include turbidity, chlorine residuals (free, combined and total), temperature and pH. These parameters are analyzed according to standardized DWSP protocols to allow for interplant comparison.

Program Input - Laboratory Analytical Data

The third major input to DWSP is Laboratory Analytical Data. Samples gathered from the raw, treated and distribution sampling sites are analyzed for the presence of approximately 180 parameters at a frequency of two to twelve times per year. Sixty-five percent of the parameters are organic. Parameters measured may have health or aesthetic implications when present in drinking water. Many of the parameters may be used in the treatment process or may be treatment by-products. Due to the nature of certain analytical instruments, parameters may be measured in a "scan" producing some results for parameters that are not on the DWSP priority list, but which may be of interest. The majority of parameters are measured on a routine basis. Those that are technically more difficult and/or costly to analyze, however, are done less frequently. These include Specific Pesticides and Chlorophenols.

Although the parameter list is extensive, additional parameters with the potential to cause health or aesthetic related problems may be added provided reliable analytical and sampling methods exist.

All laboratory generated data is derived from standardized, documented analytical protocols. The analytical method is an integral part of the data and as methods change, notation will be made and comparison data documented.

Program Input - Parameter Reference Information

The fourth major input to DWSP is Parameter Reference Information. This is a catalogue of information for each substance analyzed on DWSP. It includes parameter name and aliases, physical and chemical properties, basic toxicology, world-wide health limits, treatment methods and uses. The Parameter Reference Information is computerized and can be accessed through the Query function of the DWSP database. An example is shown in figure 1.

Program output - Query

All DWSP information is easily accessed through the Query function, therefore, anything from addresses of plant personnel to complete water quality information for a plant's water supply is instantly available. The DWSP computer system makes relatively complex inquiries manageable. A personal password allowing access into the DWSP query mode in all MOE offices is being developed by the DWSP group.

Program Output - Action Alerts

Drinking Water quality in Ontario is evaluated against provincial objectives as outlined in the Ontario Drinking Water Objectives publication. Should the reported level of a substance in treated water exceed the Ontario Drinking Water Objective, an "Action Alert" requiring resampling and confirmation is issued. This assures that operational staff, health authorities and the public are notified as soon as possible of the confirmation of an exceedance and remedial action taken. This report supplies a history of the occurrence of past exceedances at the plant plus a historical summary on the parameter of concern.

In the absence of Ontario Drinking Water Objectives, guidelines/limits from other agencies are used. The Parameter Listing System, published by MOE (ISBN 0-7729-4461-X), catalogues and keeps current guidelines for 650 parameters from agencies throughout the world. If these guidelines are exceeded, the results are flagged and evaluated by DWSP personnel. An "Action Alert" will be issued if warranted.

Program Output - Report Generation

Custom reports can be generated from DWSP to meet MOE Regional needs and to respond to public requests.

Program Output - Annual Reports

It is the practice of DWSP to produce an annual report containing analytical data along with companion plant information.

FIG.1

MOE - DRINKING WATER ASSESSMENT PROGRAM (DWSP)

PARAMETER REFERENCE INFORMATION

BENZENE (B2001P) VOLATILES

CLASS: HEALTH METHOD: POCODO UNIT: µg/L

SOURCE	FROM	TO	METHOD	GUIDELINE	UNIT	NOTE
CAL C	85/01			0.700	µg/L	AL
CDWG C	87/01			5.000	µg/L	MAC
EPA C	87/07			5.000	µg/L	MCL
EPAA C	80/11			6.600	µg/L	AMBIENT **
FERC C	84/05			1.000	µg/L	MCL
WHO C	84/01			10.000	µg/L	GV

DESCRIPTION:**NAME:** BENZENE
CAS#: 71-43-2
MOLECULAR FORMULAE: C_6H_6
DETECTION LIMIT: (FOR METHOD POCODO) 0.05 µg/L
SYNONYMS: BENZOL; BENZOLE; COAL NAPHTHA; CARBON OIL (27). CYCLOHEXATRIENE (41).
CHARACTERISTICS: COLOURLESS TO LIGHT-YELLOW, MOBILE, NON-POLAR LIQUID, OF HIGHLY REFRACTIVE NATURE, AROMATIC ODOUR; VAPOURS BURN WITH SMOKING FLAME (30).
PROPERTIES: SOLUBILITY IN WATER: 1780-1800 mg/L AT 25C (41). THRESHOLD ODOUR: 0.5 - 10 PPM IN WATERTHRESHOLD TASTE: 0.5 mg/L IN WATER (39).
ENVIRONMENTAL FATE: MAY BIOACCUMULATE IN LIVING ORGANISMS AND APPEARS TO ACCUMULATE IN ANIMAL TISSUES THAT EXHIBIT A HIGH LIPID CONTENT OR REPRESENT MAJOR METABOLIC SITES, SUCH AS LIVER OR BRAIN; SMALL QUANTITIES EVAPORATE FROM SOILS OR ARE DEGRADED RATHER QUICKLY (80).
SOURCES: COMMERCIAL: PETROLEUM REFINING; SOLVENT RECOVERY; COAL TAR DISTILLATION (39); FOOD PROCESSING AND TANNING INDUSTRIES; COMBUSTION OF CAR EXHAUST.
ENVIRONMENTAL: POSSIBLE SOURCE IS RUNOFF.

USES: DETERGENTS; NYLON; INTERMEDIATE IN PRODUCTION OF OTHER COMPOUNDS, SUCH AS PESTICIDES; SOLVENT FOR EXTRACTION AND RECTIFICATION IN RUBBER INDUSTRY; DEGREASING AND CLEANSING AGENT; GASOLINE.

TOXICITY: RATING: 4 (VERY TOXIC).
ACUTE: IRRITATING TO MUCOUS MEMBRANES; SYMPTOMS INCLUDE RESTLESSNESS, CONVULSIONS, EXCITEMENT, DEPRESSION; DEATH MAY FOLLOW RESPIRATORY FAILURE.
CHRONIC: MAY CAUSE ANAEMIA AND LEUKAEMIA (45); MUTAGENIC.
MODE OF ACTION: CHROMOABERRATION IN LYMPHOCYTE CULTURES.

CARCINOGENICITY: A KNOWN HUMAN CARCINOGEN.

REMOVAL: THE FOLLOWING PROCESSES HAVE BEEN SUCCESSFUL IN REMOVING BENZENE FROM WASTEWATER: GAC ADSORPTION, PRECIPITATION WITH ALUM AND SUBSEQUENT REMOVAL VIA SEDIMENTATION, COAGULATION AND FLOCCULATION, SOLVENT EXTRACTION, OXIDATION

ADDITIONAL PROPERTIES:
MOLECULAR WEIGHT: 78.12
MELTING POINT: 5.5°C (27).
BOILING POINT: 80.1°C (27).
SPECIFIC GRAVITY: 0.8790 AT 20°C (27).
VAPOUR PRESSURE: 100 MM AT 26.1°C (27).
HENRY'S LAW CONSTANT: 0.00555 ATM-M3/MOLE (41).
LOG OCT./WATER PARTITION COEFFICIENT: 1.95 TO 2.13 (39).
CARBON ADSORPTION: K=1.0; 1/N=1.6; R=0.97; PH=5.3 (41)SEDIMENT/WATER PARTITION COEFFICIENT: NO DATA

NOTES: EPA PRIORITY POLLUTANT.

Appendix B

DWSP SAMPLING GUIDELINE

i) Raw and Treated at Plant

General Chemistry	-500 mL plastic bottle (PET 500) -rinse bottle and cap with sample water three times -fill to 2 cm from top
Bacteriological	-220 mL plastic bottle with white seal on cap -do not rinse bottle, preservative has been added -avoid touching bottle neck or inside of cap -fill to top of red label as marked
Metals	-500 mL plastic bottle (PET 500) -rinse bottle and cap three times -fill to 2 cm from top -add 10 drops nitric acid (HNO_3) (**Caution:** HNO_3 is corrosive)
Volatiles (duplicates) (OPOPUP)	-45 mL glass vial with septum (teflon side must be in contact with sample) -do not rinse bottle -fill bottle completely without bubbles
Organics (OWOC),(OWTRI),(OAPAHX)	-1 L amber glass bottle per scan -do not rinse bottle -fill to 2 cm from top -when 'special pesticides' are requested three extra bottles must be filled

Cyanide	-500 mL plastic bottle (PET 500) -rinse bottle and cap three times -fill to 2 cm from top -add 10 drops sodium hydroxide (NaOH) (**Caution:** NaOH is corrosive)
Mercury	-250 mL glass bottle -rinse bottle and cap three times -fill to top of label -add 20 drops each nitric acid (HNO_3) and potassium dichromate ($K_2Cr_2O_7$) (**Caution:** HNO_3&$K_2Cr_2O_7$ are corrosive)
Phenols	-250 mL glass bottle -do <u>not</u> rinse bottle, preservative has been added -fill to top of label
Radionuclides (as scheduled)	-4 L plastic jug -do <u>not</u> rinse, carrier added -fill to 5 cm from top
Organic Characterization (GC/MS - once per year)	-1 L amber glass bottle; instructions as per organic -250 mL glass bottle -do <u>not</u> rinse bottle -fill completely without bubbles

<u>Steps:</u>

1. Let sampling water tap run for an adequate time to clear the sample line.

2. Record time of day on submission sheet.

3. Record temperature on submission sheet.

4. Fill up all bottles as per instructions.

5. Record chlorine residuals (free, combined and total for treated water only), turbidity and pH on submission sheet.

ii) Distribution Samples (standing water)

General Chemistry	-500 mL plastic bottle (PET 500) -rinse bottle and cap with sample water three times -fill to 2 cm from top
Metals	-500 mL plastic bottle (PET 500) -rinse bottle and cap three times -fill to 2 cm from top -add 10 drops nitric acid (HNO_3) (**Caution:** HNO_3 is corrosive)

Steps:

1. Record time of day on submission sheet.
2. Place bucket under tap and open cold water.
3. Fill to predetermined volume.
4. After mixing the water, record the temperature on the submission sheet.
5. Fill general chemistry and metals bottles.
6. Record chlorine residuals (free, combined and total), turbidity and pH on submission sheet.

iii) Distribution Samples (free flow)

General Chemistry	-500 mL plastic bottle (PET 500) -rinse bottle and cap with sample water three times -fill to 2 cm from top
Bacteriological	-250 mL plastic bottle with white seal on cap -do <u>not</u> rinse bottle, preservative has been added -avoid touching bottle neck or inside of cap -fill to top of red label as marked

Metals	-500 mL plastic bottle (PET 500) -rinse bottle and cap three times -fill to 2 cm from top -add 10 drops nitric acid HNO_3 (**Caution:** HNO_3 is corrosive)
Volatiles (duplicate) (OPOPUP)	-45 mL glass vial with septum (teflon side must be in contact with sample) -do <u>not</u> rinse bottle, preservative has been added -fill bottle completely without bubbles
Organics (OWOC) (OAPAHX)	-1 L amber glass bottle per scan -do <u>not</u> rinse bottle -fill to 2 cm from top

<u>Steps:</u>

1. Record time of day on submission sheet.

2. Let cold water flow for five minutes.

3. Record temperature on submission sheet.

4. Fill all bottles as per instructions.

5. Record chlorine residuals (free, combined and total), turbidity and pH on submission sheet.